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Can behavioural economics make us healthier and more ethical?

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Doctor of Philosophy

THE UNIVERSITY *of* EDINBURGH

The University of Edinburgh

School of Economics

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Contents

Declaration of Own Work

I declare that this thesis is an original report of my research, has been written by me and has not been submitted for any previous degree. The experimental work in Chapter 1 is entirely my own work. The work presented in Chapter 2 is joint work with Jan Bauer, Michèle Belot and Marina Schröder. I conceived the study, with the help of my supervisor Michèle Belot, and piloted it. The development and implementation was done with the help of Michèle Belot and Marina Schröder. The data analysis is mostly entirely my own. The experimental work in Chapter 3 was conceived by Michèle Belot, Jonatan James and Nicolai Vitt. I contributed to the experimental design and, jointly with Nicolai Vitt, I implemented the study. The main data analysis has been carried by Nicolai Vitt.

Martina Vecchi

Per e con mamma e papá.

Fino a qui,

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Abstract of Thesis

This thesis discusses potential motivations behind unhealthy or unethical behaviour. With the experimental method and drawing on insights from behavioural economics, it identifies features of the decision making process which enhance the appearance of unethical or unhealthy behaviour. The aim is that of informing policy makers or future interventions on the ways to improve these behaviours.

The first chapter "Groups and Socially Responsible Production: An Experiment with Farmers", is about the main drivers of entrepreneurs' social responsibility. With a lab in the field experiment with farmers in Italy, I study how and whether group decision making affects the social responsibility and the ethicality of production choices. Does corporate social responsibility decrease when corporate decisions are taken by several people (a corporate board) instead of an individual entrepreneur? And if so, why? I ask to 126 farmers in Tuscany to choose between an ecological and non-ecological but more profitable product to use in their farm. To study the effect of collective decision making, I introduce two experimental variations in a 2x2 design: (i) the number of people responsible for the decision (one vs three) and (ii) the number of people receiving a payoff from the decision (one vs three). I find that collective payoff leads to less socially responsible decisions, possibly because it provides them with the moral wiggle room to be less pro-social. On the other hand,

sharing the responsibility of the decision with others does not change behaviour in this setting, meaning that there is no diffusion of responsibility, in contrast to what has been found in laboratory experiments. To shed light on the external validity of my results, I find that my experimental measure of social responsibility correlates with measures of social responsibility outside the lab.

The second chapter "Rewarding with a food makes that food more appealing", studies with a field experiment the impact of using a food as reward. The chapter is joint work with Jan Michael Bauer, Michèle Belot and Marina Schröder. Parents often use sweet and calorie dense foods to reward their children. We hypothesize that such practices may contribute to the formation of unhealthy food preferences. To test this hypothesis, we conducted a randomized field experiment with 214 children in 3 schools in Germany. In the treatment classes, children were asked to complete a cognitive task in 6 visits over 3 weeks, and received dried apples as a reward. The task consisted of counting a number of random dots in several different pictures. In the control group classes, children received the dried apple unconditionally. Receiving the food for solving the tasks might provoke a positive association of the food with the positive feeling of achievement. It could also be that having to provide effort to obtain a food enhances the value of that food. We split the treatment groups into two, varying the number of pictures between the two treatment groups. This allows us to identify the role of effort in driving a change in preference for dried apple. Our results show that rewarding children with food does increase their liking for the food reward. Also, increasing the effort required to obtain the reward does not impact the liking. These findings suggest that parents and carers should avoid using unhealthy food as rewards and may even use this mechanism to increase the liking of healthy food by using such foods as rewards.

The third chapter, "Stress and Food Preferences: A Lab Experiment with Low Income Mothers", discusses the influence of stress on food preferences. Jointly with Michèle Belot, Jonathan James and Nicolai Vitt, we conduct a lab experiment with 196 low-income mothers in the UK to study the impact of acute stress on immediate and planned food choices. We propose two channels through which stress might affect food choices: (i) by affecting individuals' preferences and (ii) by affecting their ability to make sound decisions. With a novel incentivised stress task designed to mimic stressors often experienced by mothers from a low socio-economic status, we experimentally induce acute stress on a group of participants. We take measurements of participants' salivary cortisol and heart rate over the course of the experimental sessions to assess the stressfulness of the stress task. Afterwards, we ask them to purchase food items in a "virtual supermarket" and also we offer them high-and low-calorie snacks. We use the nutritional content of the chosen food-shopping basket and the quantity of snacks consumed to determine the impact of acute stress on planned and immediate food consumption choices, respectively. Contrary to previous findings in the literature, we find no evidence of an effect of acute stress on immediate or planned food choices.

Lay Summary

Individuals often take decisions that are less than healthy and responsible with respect to the environment. In some cases, subjects take these decisions wilfully, comparing costs and benefits in health or for society and the personal utility of their actions. In other cases, biases and factors contingent on the choice lead them to take these unhealthy or unethical decisions. In this thesis, I study potential motivations behind unhealthy and unethical behaviour providing experimental evidence from the laboratory and the field, with the intent of identifying tools to improve them.

The first chapter "Groups and Socially Responsible Production: An Experiment with Farmers", studies the main drivers of entrepreneurs' social responsibility. Here I investigate how decisions made by board of directors in the interest of multiple stakeholders are different from decisions made by single individuals for own profits. In particular, I separate the effect of two dimensions of group decision making on social responsibility: i) sharing the responsibility of the decision with multiple people and ii) sharing the profits and the benefits of the decision with multiple people. If behaving unethically bears a cost, sharing the responsibility of the decision might diffuse the cost of taking the non-socially responsible action. Sharing the benefits of the decision might allow participants to take the non-socially responsible choice disregarding the social cost, in the interest of their group. To study this, I ask 126

Italian farmers to choose between a pair of ecological working gloves and a pair of non-ecological working gloves for their farm, where the non-ecological working gloves allow them to also receive an amount of money. Each farmer takes his decision either individually for own profits, or by majority with other subjects, or with benefits and payoff for the group. I find that sharing the responsibility of the decision does not modify choices. Sharing the benefits of behaving unethically instead leads to less socially responsible choices, by allowing farmers to take the non-socially responsible and more profitable choice in the interest of the group.

The next two chapters are in the area of behavioural health economics. In chapter 2 "Rewarding with a food makes that food more appealing" I study, jointly with Jan Michael Bauer, Michèle Belot and Marina Schröder, the impact of rewarding with food on its liking. In our culture sweets are frequently presented in a positive social-affective context: they are present at parties, at holiday celebrations such as Christmas and Easter, they are used as reward and reinforcer of good behaviours. Using food to reward effort might increase its evaluation either to justify the effort exerted to obtain the reward or because of the association of the food with the feeling of being rewarded. For these reasons, one may worry that these practices might be exacerbating the rise in obesity and unhealthy eating: using treats might be increasing their valuation influencing formation of the "sweet tooth" and contributing to the obesity epidemic. We study this in a field experiment with 214 first graders in Germany, where we offer children a dried apple as a reward for completing an effort task. We find that rewarding children with food increases their liking for the food reward. We also explore whether is the effort to obtain the food-reward to induce higher liking, modifying the effort required to obtain the dried apple. We find that exerting more effort does not impact the liking of the food reward, suggesting that

the positive association of the dried apple with the feeling of accomplishment is the main driver of the effect. These findings suggest that the common practice of using (typically high in calorie) foods as rewards may contribute to their appeal. Parent and child carer should then either abstain from this practise or use healthier foods to reward their children, to promote their liking.

Chapter 3 "Stress and Food Preferences: A Lab Experiment with Low Income Mothers" is on stress and its impact on immediate and planned consumption choices. Jointly with Michèle Belot, Jonathan James and Nicolai Vitt, we conduct a laboratory study in Essex with 196 mothers from a low socio-economic background. We induce stress with an incentivized decision task, tailored to mimic stressors usually experienced by low socio economics mothers, and measure it with a questionnaire and collecting several biomarkers (salivary cortisol and testosterone, hear-rate variability). Afterwards, we ask these mothers to do their weekly food and drinks shopping with a £30 budget from a "virtual supermarket". We also offer them high-and low-calorie snacks. We use the nutritional content of the chosen food-shopping basket and the quantity of snacks consumed to determine the impact of acute stress on planned (in the virtual supermarket) and immediate (consumption of the two snacks offered) food consumption choices. Contrary to previous findings in the literature, we do not find evidence of an effect of acute stress on immediate or planned food choices.

Chapter 1. Groups and Socially Responsible Production: An Experiment with Farmers

Does corporate social responsibility decrease when corporate decisions are taken by several people (a corporate board) instead of an individual entrepreneur? And if so, why? I study these questions in a lab-in the field experiment involving 126 Italian farmers. They are asked to choose between an ecological and non-ecological but more profitable product to use in their farm. To study the effect of collective decision making, I introduce two experimental variations in a 2x2 design: (i) the number of people responsible for the decision (one vs three) and (ii) the number of people receiving a payoff from the decision (one vs three). I find that collective payoff leads to less socially responsible decisions, possibly because it provides participants with the moral wiggle room to be less pro-social. On the other hand, sharing the responsibility of the decision with others does not change behaviour in this setting, meaning that there is no diffusion of responsibility, in contrast to what has been found in other laboratory experiments. To shed light on the external validity of my results, I find that my experimental measure of social responsibility correlates with measures of

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social responsibility outside the lab.

1.1 Introduction

The interest in corporate social responsibility (SR[1]) and consumers' willingness to pay for the socially responsible quality of products has been on a rise in recent years. The media often report corporate scandals and ethical failures. For example in 2015 Volkswagen admitted cheating emissions tests, after the Environmental Protection Agency (EPA) found that many VW cars being sold in America had a "defeat device" to detect when their diesel engine was being tested [16].What are the main drivers drivers of entrepreneurs' social responsibility? By understanding the impact of different factors, we could foster the internalization of the costs for the society of non-socially responsible actions.

The first contribution of this chapter is to separate the relative impact of two different dimensions of group on social responsibility of choices with a single experiment: (i) the number of people responsible for the decision (one vs three) and (ii) the number of people receiving the payoff and benefits from the decision (one vs three). I also separate three possible forces (i) diffusion of responsibility (ii) ingroup bias and (iii) self-serving altruism. I find that payoff commonality reduces social responsibility and increases the focus on payoff by creating the moral wiggle room for subjects to feel socially responsible while acting unethically "in the interest of the ingroup" (self-serving altruism). I do not find evidence that deciding with other subjects by majority diffuses responsibility and has an impact on social responsibility of choices.

[1]Depending on context, I define SR as both "socially responsible" and "social responsibility".

The second contribution is to study producers' social responsibility with actual producers. With a framed-field experiment (FFE) with 126 agricultural producers in Italy, members of one of the main unions of Italian farmers (CIA, Confederazione Italiana Agricoltori), I study farmers' attitudes towards purchasing a socially responsible product for their farm. With a 2x2 design, I separate the importance of sharing responsibility for the decision and payoff commonality. I ask producers to choose between a pair of ecological working gloves for their farm, the socially responsible product, and a pair of non-ecological working gloves which allow them to additionally earn a sum of money. They take the choice either individually (in the 'I - I' and 'I - C' treatments) or collectively by majority with two other people (in the 'C - I' and 'C - C' treatments)[2]. Furthermore, the benefits and the payoff can be individual for the participant deciding (in the 'I - I' and 'C - I' treatments) or for the group (in the 'I - C' and 'C - C' treatments). In this experiment, if the payoff is for the group, it is not shared among people but each subject receives the same payoff.

If taking a non-socially responsible decision bears a cost, collective decision making might diffuse responsibility for the choice and share the cost of acting non-responsibly among decision makers, leading to lower social responsibility [52, 46, 72]. I do not find evidence for diffusion of responsibility.

I find instead that payoff commonality reduces social responsibility and increases the focus on payoff. With payoff commonality, being responsible for stakeholders' payoff might lead the decision maker to maximize the payoff of the ingroup disregarding the social cost, showing ingroup bias and lowering social responsibility [43, 7]. Payoff commonality might also allow the decision maker to justify non socially responsible actions with self-serving altruism: deciding for the payoff of the group, not only

[2]The four treatments are 'I - I', 'I - C','C - I' and 'C - C', where the first letter refers to the decision maker (individual decision I vs collective decision C) and the second letter refers to who receives the payoff (individual payoff I vs collective payoff C).

for own payoff but also group-mates' payoff, might allow subjects to feel socially responsible while choosing the economic profit "in the interest of the group-mates". Payoff commonality might create the moral wiggle room for subjects to act selfishly while keeping their socially responsible image [6, 39]. To investigate these two hypothesis about payoff commonality, I also collect farmers' decision about the payoff of a group-mate (only). If subjects show ingroup bias, they care about group-mates' payoff and maximize group-mates payoff also when their payoff is not affected. If subjects show self-serving altruism in contrast, they maximize group-mates payoff solely when their own payoff is also affected by the decision, i.e. when deciding for their own and group-mates payoff (under payoff commonality) but not when deciding only for a group-mate. I find that payoff commonality reduces social responsibility by creating the moral wiggle room for subjects to feel socially responsible while acting non-responsibly "in the interest of the ingroup" (self-serving altruism).

Both consumers and producers often face ethical dilemmas that involve a trade-off between a low payoff (high cost) without negative externalities or a higher payoff (lower cost) with negative externalities. Consumers' attitudes towards socially responsible products have been studied both in the lab with consumers (students and different populations) and outside the lab [50, 28, 69]. The attitude of producers and its determinants has instead been mainly overlooked, considered as a response to consumers' demand for social responsibility [12, 47] or only studied in the context of a trade in the laboratory between students. Enhancing the credibility and the transparency of labels, signalling socially responsible production, increases the price consumers are willing to pay [60, 32, 37]. The scope of the externality (whether the party affected by the negative externality is a single third party or several subjects) has just a small effect [9].

Several studies have shown how student and non-student samples behave differently in experiments.[3] People seem to display lower moral reasoning when responding to work related dilemmas compared to non-work dilemmas and subjects with different roles in an organization have different behaviours [70, 71]. Treviño et al. [68] find that managers and partners in public accounting firms have lower moral reasoning scores than those at lower organizational levels in the firm. Elm and Nichols [30] find similar results in a more general management sample, where longer tenured managers show lower moral judgment scores. The causal link between whether people with different levels of moral reasoning select themselves into different roles, or whether the work environment defines moral judgment [67] is unclear. However, production decisions taken by non-producers could be unrealistic and lead to different choices. Framed field experiments (FFE) could help solve the problem of the "non representativeness" of a student (consumers) sample when taking decisions about social responsibility in production [55, 53]. FFE are lab experiments with a non-standard subject pool and a field context in the commodity and task used [40], are a step that progresses from experiments in the lab toward the environment of interest [55, 53], allowing us to learn the influence of different factors on the behaviour of specific populations or in specific situations. Abstracting from the context, we do indeed lose the ability to replicate shared norms and group identity (i.e. as producers) [42], and the representation of the commodity by the subject is an integral part of how he solves a task. By using a FFE with producers, I am able to study social responsibility with subjects accustomed to taking this type of decisions for their company,

[3]Miller et al. [58] and Cappelen et al. [19] invited standard and non-standard (non-students) subject pools to the lab to play classic experimental games and strategical games (in Miller et al. [58] both groups are inexperienced). The authors find analogous comparative statics, but substantial differences in the behaviour of the two subject pools with respect to other-regarding preferences (students display lower other-regarding concerns). In studies of ethical behaviour, the use of non-standard subject pools is likely to lead to different results.

and who know the importance of profit and being socially responsible in business. In addition, it allows me to ask producers about selecting and receiving a commodity they will use for their business, the ecological or non ecological working gloves. Finally, surveying entrepreneurs offers a chance to link socially responsible behaviour (in an individual donation decision they take during the experiment mainly, but also in the product decision) to the characteristics of their company. This allows me to check the external validity of the effect of payoff commonality and collective decision making on socially responsible choices. Despite the fact that outside the lab the number of people who share profits and decision making power with the farmer is not randomly assigned, it is interesting to analyse the link between social responsibility, the number of employees (who have "payoff commonality" with the entrepreneur) and the number of subjects with decision-making power in the farm.

This chapter also relates to the literature on group decision making. While the impact of the two dimensions of collective decision making and collective payoff has never been disentangled, group behaviour has been studied broadly, also in the "ethical" domain. Groups often behave differently from individuals. In the domain of socially responsible behaviour, studies show that decisions taken with a partner about common payoff (two people are needed to complete the trade of an unethical product) lead to more unethical choices [35, 46, 45]. In games, groups usually behave more closely to the equilibrium and learn better [56, 15]. They are better at coordinating [38] but reach a lower level of social welfare when trust is crucial to achieve it. Moreover, groups show lower altruism concerns (towards the outgroup members) and have higher concerns for maximizing the group's joint payoff [22] (see Charness and Sutter [23] for a review). The review by Kugler et al. [51] shows that in interacting tasks (strategic situations) groups are more rational, competitive and

oriented towards payoff-maximisation. In non-strategic situations, groups usually exhibit weaker biases than individuals.[4]

The next section introduces the sample of this experiment; sections 1.2.2 and 1.2.3 outline the hypotheses and the experiment design; section 1.2.2 describes the purchase decision and the hypotheses related to groups' decisions, 1.2.3 describes the donation decision and the survey. Section 1.3 outlines the hypotheses and predictions of the experiment. Section 1.4 presents the results of the study, showing both the non-parametric statistics and the regression analysis.

1.2 Experimental Design

To study producers' behaviour, I run a framed field experiments with 126 Tuscan farmers, associates of the Confederazione Italiana Agricoltori (CIA, Italian Farmers Confederation).[5]

1.2.1 Sample and Recruitment Procedure

I contacted the Tuscan CIA via email, inviting them to collaborate on a project aimed at understanding entrepreneurial choices. In meetings with the general director and the vice-president of the CIA Tuscany, I gave general information about the research (mainly information about the collaboration and the help needed from the association). The project was presented to the regional CIA presidents by the general director and the vice-president with a leaflet describing the aim of the study, but not containing details about the research question (Appendix 1.5.2, figure 1.5.1).

[4]For example, groups exhibit lower overconfidence bias [66] and make fewer errors in risky choices [20, 33].

[5]Ethical approval to conduct the study was obtained from the Ethics Sub-Committee of the School of Economics of The University of Edinburgh.

The experiment was run during the local and regional assemblies of CIA Firenze, Arezzo, Siena, Massa Carrara and Grosseto. Information about the union is in Appendix 1.5.1.

At the beginning or at the end of the assembly, depending on the time of day and the needs of the CIA president and directors, the president of the province would introduce the study and invite attendees to participate. On average, 90% of the assembly participants agreed to take part in the study. The number of participants in each session was between 6 and 19, with 126 participants in total. I ran 12 sessions in total: 8 in Florence, 1 in Arezzo, 1 in Massa Carrara, 1 in Grosseto and 1 in Siena. The experiment was run pen and paper, in the same room as the assembly. Participants were given a paper questionnaire with the informed consent form (Appendix 1.5.2, figure 1.5.2) and the instructions of the experiment, which was structured in 3 parts. A translated version of the instructions is in Appendix 1.5.6. The informed consent and introduction were read out loud, sessions lasted between 30 to 45 minutes. Answers were then matched in a separate room and any potential earning was put in an envelope with the ID of the participant, to pick up before leaving the meeting. In each session I ran multiple treatments, placing at least 2 to 4 people to treatments requiring collective decision making or sharing payoff.[6] Each participant was assigned to a different treatment, with a between subject design with the exception of the decision about the group-mate, which was a within subject decision.

1.2.2 Product Decision

Producers have the opportunity to take a decision about receiving a product for their farm and earn a sum of money. The choice is between receiving (i) a pair

[6]Despite trying to avoid creating groups with a number different from 3 subjects, it was impossible to forbid people to leave meetings after receiving the paper questionnaire, hence after being assigned to treatments.

of ecological working gloves or (ii) a pair of non-ecological working gloves plus a monetary bonus. The ecological working gloves are the socially responsible option (SR), participants know they are made from sustainable and recyclable bamboo and produced in sweat-free plants. The non-ecological working gloves are the non socially responsible but profitable option (NonSR), since they allow them receiving a monetary bonus. Participants know they are made in non recyclable nylon and no information is given about production. Participants also know the two pairs of gloves have similar market prices (around 15 euro), fulfil the same function and have the same characteristics. Decisions are elicited in a price list, with subjects taking 10 different decisions with a varying bonus for selecting the non-ecological gloves. The non-ecological gloves (NonSR) allow the farmer (or his group, if the treatment implements payoff commonality) to receive a sum of money (bonus) that varies in the 10 different choices faced. The bonus varies in steps of 2 euro, from 2 to 20 euro. If subjects care about social responsibility (and the socially responsible quality of goods), choosing the non-ecological gloves gives them a disutility from producing the negative externality but allows them to receive a varying monetary amount. Subjects know that one of the 10 decisions will be randomly drawn and implemented, if they are selected in this part. For 2/3 of subjects none of their choices about their own payoff is implemented in this part, their decision is though implemented in the donation decision. An example of the decision pairs for the 'I - I' treatment, with individual decision and individual payoff, is displayed in figure 1.2.1.

I define the willingness to pay for the socially responsible quality of the good (WtpSR) as the highest monetary amount subjects are willing to forgo to "purchase" ecological gloves (subjects still prefer receiving socially responsible gloves than non socially responsible gloves plus the amount of money offered). The lower the switch-point,

the less a subject cares about the socially responsible quality of the good and hence the more non-soially responsible the subject is.

SELECT THE BOX CORRESPONDING TO THE PURCHASE DECISION YOU PREFER FOR EACH DECISION PAIR (ONLY ONE BOX PER DECISION PAIR)

DECISION PAIR 1	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **2 euro** ☐
DECISION PAIR 2	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **4 euro** ☐
DECISION PAIR 3	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **6 euro** ☐
DECISION PAIR 4	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **8 euro** ☐
DECISION PAIR 5	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **10 euro** ☐

Figure 1.2.1: Decision pairs for the 'I - I' Treatment.

Treatments

In a 2x2 design I ask producers to take the decision about the product, varying the number of decision makers (individual decision vs collective decision of the group by majority) and the number of people receiving the benefits and the payoff of the decision (gloves and bonus for the individual vs gloves and bonus for the 3 group-mates).

Table 1.2.1: Treatment groups

		Decision	
		Individual	Collective
Payoff	Individual	I - I	C - I & Group-mate
	Collective	I - C	C - C

Choices are taken individually by each subject, pen and paper. If treatments implement individual decision making, the decision of the subject is implemented. If they implement collective decision making, the final choice is the one selected by the majority. There is no communication between group members and full anonymity of choices. With respect to payoff, in case of individual payoff the subject receives a pair of the chosen gloves and the additional bonus corresponding to the decision selected for payment. With collective payoff, each subject in the group receives a pair of the chosen gloves and the bonus associated with the decision selected for payment. Each subject receives the bonus and a pair of the gloves, to keep the negative externality and the gain from the decision constant for each subject. By doing this, I keep constant across treatments the individual trade-off between being socially responsible and monetary amount (for each choice pair). For example, in decision pair 5 for 10 euro (figure 1.2.1), the treatments 'I - I' and 'C - I' offer a

choice between 1 pair of SR gloves or 1 pair of non SR gloves and 10 euro. The corresponding decision in treatments 'I - C' and 'C - C' offers a choice between 1 pair of SR gloves or 1 pair of non SR gloves plus 10 euro, for the subject himself and for two other subjects. Table 1.2.2 shows the decision a subject faces in decision pair 5 in all the treatments.

If subjects assigned to a group treatment leave after the assignment to treatment, I form groups of either 2 or 4 participants. In case of collective payoff, the same payoff is given to 2 or 4 members, instead of 3. In case of collective decision making, the choice of the selected participant applies only to one other subject instead of 2.

Table 1.2.2: Decision pair 10

Treatment	**Socially responsible + 0 €**	**Non Socially responsible + 10 €**
I - I	1 ecological gloves + 0 €	1 non-ecological gloves + 10 €
C - I [a]	1 ecological gloves + 0 €	1 non-ecological gloves + 10 €
I - C [b]	3 ecological gloves + 0 €	3 non-ecological gloves + 30 €
C - C [a,b]	3 ecological gloves + 0 €	3 non-ecological gloves + 30 €

[a] Decisions taken by majority with 2 other team-members.
[b] 1 pair of gloves for each team member and 10 euro for each team member.

The product decision is implemented for a randomly selected subgroup of participants, those not selected in this part are selected in a second part of the experiment (donation decision). If selected, of the 10 decision pairs 1 is chosen at random and the participant (and his group, if the treatment implements collective payoff) receives the chosen gloves and any monetary payment.

Every participant takes the 10 decisions related to the treatment he is assigned to, and then I implement and pay the decision of 1/3 of participants. In the 'I - I' treatment, every subject decides what to receive between ecological or non-ecological

working gloves plus the monetary bonus. Only 1 every 3 subjects will then receive what he choose in the randomly selected decision pair. In the 'C - C' treatment, each group decides by majority between ecological or non-ecological gloves plus monetary bonus. Only 1 every 3 groups will then receive what chosen in the randomly selected decision pair. In the 'I - C' treatment, each subject decides for himself and for his 2 group-mates between ecological or non-ecological gloves plus monetary bonus. Only 1 of the 3 subjects in the group will then be selected and be the decision maker. The group will receive what was chosen by the decision maker in the randomly selected decision pair. In the 'C - I' treatment, each subject decides for himself between ecological or non-ecological gloves plus monetary bonus. Here, each subject takes the decision for his payoff, knowing his payoff is going to be determined by his decision and also the decision of his 2 group-mates about his payoff. Then, only 1 of the 3 subjects in the group will be selected to be the one receiving the payoff ('receiver'). The 'receiver' will get what was chosen by his group in the decision pair randomly selected. In 'C - I', each subject is also asked a second decision for one of his group-mates. The decision is what he wants his group-mate to receive between ecological or non-ecological gloves plus monetary bonus. In case the subject is not selected to be the one receiving the payoff, this second decision will be implemented to determine by majority the payoff of the 'receiver'. I use this within subject decision to compare the social responsibility of farmers when deciding (also) for themselves and when deciding (only) for another subject. Figure 1.2.2 shows the decisions in the four treatments.

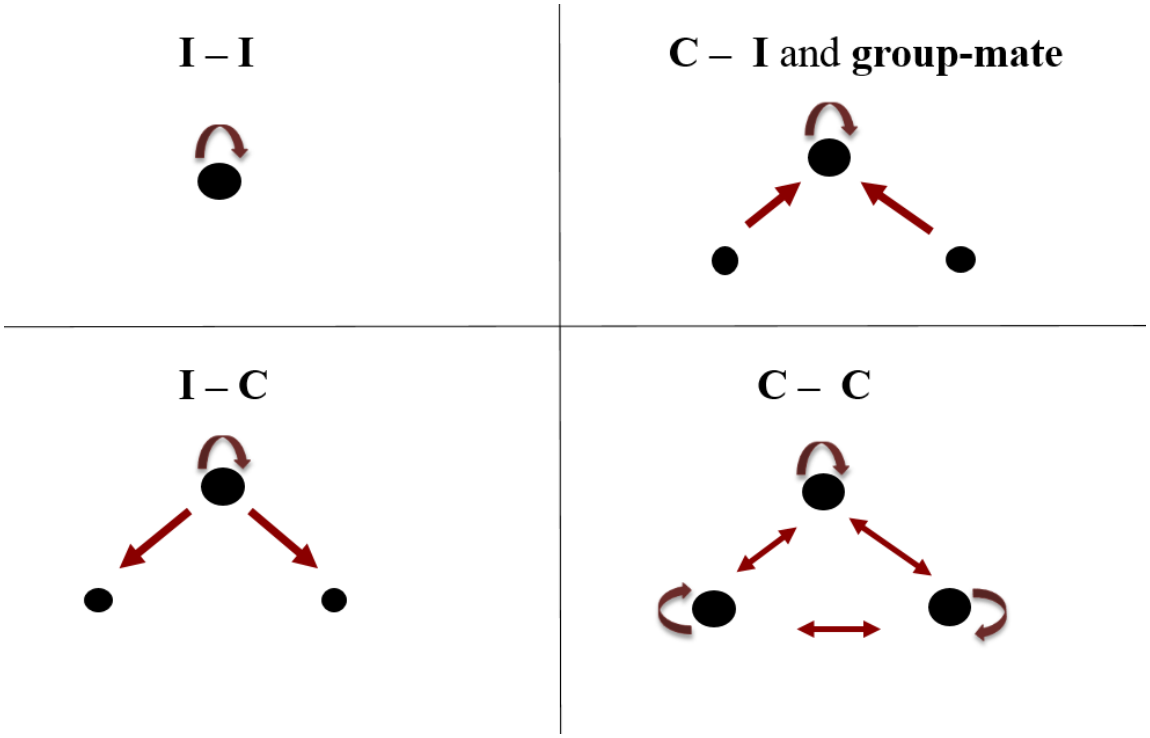


Figure 1.2.2: Decision Making Assignment

1.2.3 Donation Decision and Survey

To have a baseline of social responsibility and study the correlation between social responsibility in the lab and the two dimension of (i) number of decision makers and (ii) the number of stakeholders outside the lab, I ask farmers to make an individual donation decision and I collect several characteristics of their farm via a survey.

I collect individual donation decisions in a choice list setting. I use this decision to control for heterogeneity in preferences for "being socially responsible", and I also correlate it with subjects' business characteristics. Similarly to Kirchler et al. [46], subjects decide about the varying monetary payment (which mimics the utility gain from buying a good) at the cost of creating a negative externality to an uninvolved third party in the choice list setting. The negative externality is created when deciding to not donate to a non-governmental organization and keep the money. I

mantain the negative externality of keeping the money constant at 5 euro, which allows me to study the subjective cost of behaving non socially-responsibly. Farmers take an individual choice between 2 alternative outcomes, in a list of 15 decision pairs. Each of the 15 decisions is between getting a payoff ranging from 0 euro to 28 euro for themselves, increasing in steps of 2 euro, and a donation of 5 euro to ASeS (Agricoltori Solidarietà e Sviluppo, farmers solidarity and development).[7] I randomly draw and pay one of the 15 decision pairs for 2/3 of subjects, those not selected in the product decision. An example of the decision pairs for this part is shown in figure 1.2.3. I define the willingness to pay for the donation (WtpD) as the highest monetary amount the farmer is willing to forego to give 5 euro to ASeS.

[7]ASeS is the non-governmental organization (NGO) supported by the CIA, whose mission is to support rural communities in developing countries by developing their agricultural capacities, increasing the availability of new technologies and improving the socio-sanitary conditions of the villages.

SELECT THE BOX CORRESPONDING TO YOUR PREFERRED ALTERNATIVE FOR EACH DECISION PAIR (15 crosses)

DECISION PAIR 1:	**X)** **0 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 2 :	**X)** **2 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 3 :	**X)** **4 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 4 :	**X)** **6 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 5 :	**X)** **8 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 6 :	**X)** **10 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 7 :	**X)** **12 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐

Figure 1.2.3: Donation Decision Pairs

I also ask farmers to fill in the survey in Appendix 1.5.6, part 1.5.13. The survey contains firstly questions about the farm: how long has their farm has been in business for (years in business), number of people taking decisions in the farm (n. of decision makers), number of employees, yearly revenues, presence of any certifications (organic, locally produced) and whether they purchase organic goods for production. Secondly, the survey asks questions about farmers. I measure on a likert scale from 1 to 7 whether farmers perceived as non-socially responsible to select the non-ecological gloves and to not donate to the NGO in the study, and the influence on the product decision of having to decide for others/in a group. I ask farmers whether they think other participants in the session are more ethical (+1), as ethical (0) or less ethical (-1) then themselves (other's ethicality). Finally, the survey includes the GREEN scale by Haws et al. [41], to predict preference for environmentally friendly products, reported in Appendix 1.5.3. I calculate a greenness score as the average of the scores across the 6 questions of the scale.

Farmer's are on average 44 years old, 32% is female (which, according to the OECD data, is in line with the average trend in Italy, where the percentage of female entrepreneurs is quite high), the average "greenness score" is of 6 out of 7 (where the average score found by Haws et al. [41] on a sample of adult American is around 4). On average they are willing to give up to €17.3 to donate €5. Farms have on average 3.4 employees, with a minimum of 1 and a maximum of 40, on average 1.93 people take decisions with a maximum of 10 people. Their farm has on average been in business for about 17 years and the farm yearly revenues are usually in the revenue brackets that goes from 30 to 50,000 €. 36% of them produces an organic product and more than half of the farmers usually purchase organic products for their farm. Groups are balanced across the different characteristics, except for the number of years in business. Controlling for this variable in the regression analysis does not

modify the results. On average they believe the other farmers in the session to be as ethical as they are, with small and insignificant difference across treatments.[8] The particular attention of the sample towards social responsibility is important, as it allows me to study behaviour across treatments of producers who usually consider the socially-responsible quality of goods. This feature should not affect the comparison between treatments, but is included as control variable in the analysis that follows. Table 1.2.3 reports the mean of each survey item for the 4 treatment groups.[9]

1.3 Hypotheses and Predictions

In the next section, I lay out a simple model based on Bartling et al. [10] to derive predictions. I then present the hypotheses related to the two dimensions of groups that could influence the social responsibility of choices: (i) the number of people responsible for the decision and (ii) the number of people receiving a payoff from the decision.

Finally, I present the hypotheses for the donation decision.

1.3.1 A simple model - Product Decision

I assume individuals potentially care about their own material payoff, the payoff of others and the social impact of their product choice. I use a linear utility function to capture these preferences, of the form

$$u_i = x_i + (n-1) \cdot \alpha_i \cdot x_j + n \cdot y_i/\delta_i + n \cdot y/\gamma_i$$

[8]Since the survey was administered after the main experiment, the answers about the ethicality of other subjects in the session and their own social responsibility might be not reliable but a response to their behaviour in the main experiment. The difference between treatments is though not significant.

[9]In 'C - C' treatment, 2 subjects did not answer to any of the survey questions and do not appear in the table

Table 1.2.3: Summary Satistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	I - I	C -I	I - C	C - C	P-value	Overall	Min	Max
Age	48.03	42.10	43.97	45.87	0.78	44.98	22	77
Female	0.27	0.35	0.26	0.35	0.83	0.31	0	1
Years in business	22.11	17.48	12.97	14.30	0.37	16.66	0.5	75
N. of employees	5.17	3.32	2.32	3.00	0.56	3.44	0	40
N. of decision makers	2.02	1.90	1.93	1.90	**0.05**	1.94	0	10
Yearly revenues	2.37	2.87	2.24	2.34	0.38	2.46	1	7
Locally produced	0.62	0.52	0.77	0.58	0.23	0.62	0	2
Organic product	0.28	0.35	0.37	0.42	0.85	0.36	0	1
Buy organic	0.55	0.48	0.62	0.58	0.79	0.56	0	1
Others' ethicality	0.04	-0.03	-0.11	0.13	0.36	0.01	-1	1
Greenness score	5.92	6.05	6.06	6.14	0.99	6.04	2.7	7
Observations	30	31	32	31		124		

Significant differences in bold, based on a one-way ANOVA on ranks (Kruskal-Wallis) test

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A monetary gain gives subject i a utility x_i, generating a monetary gain for a group-mate gives utility $\alpha_i \cdot x_j$, where α_i is the degree of altruism of the individual. Subjects with $\alpha_i = 0$ do not care about their group-mate monetary gain, while subjects with $\alpha_i > 1$ care more about monetary gain when other subjects are involved. n is the number of subjects in the group receiving the payoff. Producing a negative externality of purchasign the non-socially responsible product has a cost y_i for the individual, multiplied by the number of subjects in the group receiving the payoff n.[10] δ_i captures the diffusion of responsibility (and hence of the cost) of producing the negative externality, which depends on the number of decision makers. If the decision maker is a single individual $\delta_i = 1$, if there is more than one decision maker $\delta_i = 1$ only if responsibility does not diffuse. γ_i captures the self-serving altruism and diffusion of guilt from taking the non-socially responsible action, it depends on the number of people the subject is taking the decision for. $\gamma_i = 1$ if the subject decides only for himself or if there is not self-serving altruism.

Table 1.3.1: Utility of the Choices

	SR gloves	**Non SR gloves + Monetary Amount**
I - I	0	$x_i + y_i$
C - I	0	$x_i + y_i/\delta_i$
Group-mate	0	$\alpha_i \cdot x_j + y_i/\delta_i$
I - C	0	$x_i + (n-1) \cdot \alpha_i \cdot x_j + n \cdot y_i/\gamma_i$
C - C	0	$x_i + (n-1) \cdot \alpha_i \cdot x_j + n \cdot y_i/\delta_i + n \cdot y_i/\gamma_i$

Table 1.3.1 summarizes the utilities in different treatments. Deciding for himself

[10] n is indeed the number of subjects receiving the payoff in the group and hence the number of non-socially responsible products purchased, when subjects opt for getting the money.

in 'I - I' and 'C - I' treatments, a farmer faces a trade off between a utility from the amount of money x_i and the disutility from creating a negative externality y_i. In the 'I - C' and 'C - C' treatments, the decision of gaining the bonus for the group (x euro for the subject and each one of the group-mates) produces a negative externality y_i for each pair of non-ecological gloves purchased. One pair of gloves is purchased for each group member, to keep the social externality generated by each subject constant.

In 'C - I' subjects take the product decision also for a group-mate ($x_i = 0$), allowing me to study altruism and ingroup bias. If farmers have a lower willingness to pay for the socially responsible quality when deciding for a group-mate (i.e. care more about ensuring a monetary gain to group members than to themselves) $\alpha_i > 1$, farmers show ingroup bias. This would influence also the decision in 'I - C' and 'C - C' treatments towards a higher focus on monetary gain than in 'I - I' and 'C - I' respectively. Deciding for the group in these two treatments might also create the moral wiggle room to behave self-interestedly "in the interest of the group-mates" ($\gamma_i \neq 1$). If $\gamma_i > 1$, subjects deciding for the payoff of the group have a lower willingness to pay for"social responsibility" and a focus on monetary gain only when also their payoff is involved (and not in the decision for the group-mate). Finally, taking the decision by majority in the 'C - I' and 'C - C' treatments, the responsibility of producing the negative externality might diffuse among decision makers ($\delta_i \neq 1$). In the next sections, I present the hypothesis related to the two dimensions of groups, and the three forces that could influence SR in groups.

1.3.2 Social Preferences

A large economic literature has established that people have social preferences and behave according to moral and social norms [31, 18, 48]. In dictator games, subjects

usually give away 50% of their budget and evidence of charitable giving is broad [29, 54, 49]. Several models accommodate non-selfish motives for behaviour. Andreoni [4] builds a model of altruistic behaviour motivated by warm glow giving.[11] Fehr and Schmidt [36] and Bolton and Ockenfels [14] introduce fairness concerns and the concept of inequity aversion. Rabin [61], Charness and Rabin [21], Falk and Fischbacher [34] develop models of reciprocity that consider intentions, where people try to reward kind actions and punish unkind ones.

Socially responsible production can arise because of consumers' demand for this type of products and their willingness to pay a price premium. It can also emerge from a spontaneous internalization of the negative externalities by the firm who, out of social or environmental concerns, decides to incur the extra cost associated with socially responsible production. From lab studies on ethical markets we know that even in monopoly a firm allocates to a passive worker (wage taker) a salary different from zero, showing ethical concerns.[12]

The disutility subjects face when creating the negative externality y_i can be greater than 0. It is then predicted that some subjects are willing to give up some payoff to receive the socially responsible and more expensive goods (table 1.3.1).

Hypotesis 1. *If subjects have social preferences, some farmers select the ecological gloves:*

$$WtpSR > 0$$

[11] Warm-glow giving refers to prosocial behaviour causing donors to experience positive feelings, irrespective of whether their behaviour actually benefits others.

[12] When in a competitive market consumers start taking SR in production as a decision criterion, the share of SR products traded rises even more [60].

1.3.3 First dimension: Collective Decision Making

Diffusion of Responsibility

Many immoral acts require the support of several people, who can share the cost and the responsibility, making the action bearable. If we expect people to bear a cost when producing negative externalities, this cost can be shared when the decision is taken by a group. Diffusion of responsibility and the feeling of not being pivotal is an important adjuvant for reducing moral behaviour [62], death penalties for example are often performed by execution teams [8] and the presence of other people inhibits an individual from intervening in an emergency [52]. Schwartz [63] suggests that for a moral norm to be activated and applied, a subject must ascribe some personal responsibility to himself for an action and its consequences. Nyborg et al. [59] develop a model of ascription of responsibility where people with preferences for a responsible self image act "green" (socially responsibly) only if they ascribe to themselves the responsibility on the question at hand.

In group decisions, where majority voting makes it impossible to impute the result of the choice, subjects make more self-interested decisions [46, 45]. In Dana et al. [26], when two dictators decide (unanimously) on the amount to transfer to a third party, the generosity is lower and groups lie more to get a profit gain, if the profits for group members are aligned [72].

If the disutility subjects face when creating the negative externality y_i can be shared with other decision makers ($\delta_i > 1$), it is predicted that with collective decision making by majority subjects ascribe a lower level of responsibility to themselves and purchase fewer SR products (table 1.3.1). Less ecological gloves are chosen in the 'C - I' treatment than in the 'I - I', less ecological gloves are chosen in the 'C - C' than in the 'I - C' treatment.

Hypotesis 2. *With diffusion of responsibility, there is a higher focus on monetary gain when decision making is collective:*

$$WtpSR\ Collective\ decision < WtpSR\ Individual\ decision$$

1.3.4 Second dimension: Payoff Commonality

With payoff commonality, there is more defection in prisoner dilemma [22], a lower cooperation in public good games [44] and more cheating in the die rolling task [39]. This experiment allows me to disentangle two possible forces driving a change in social responsibility when sharing with others the benefits of behaving non-socially responsibly.

Ingroup Bias

Many findings show that subjects care about a group's payoff. The ingroup/outgroup bias is a well documented and observed phenomenon in the social sciences and is the tendency to evaluate one's own group or its members (the ingroup) more favourably than others and has been discerned in many contexts, such as teacher-student relations [1][13]. Caring for the group can also lead employees to forget about personal financial gains: if they feel part of the company they will work in the financial interest of the group without the need of strong financial incentives [2, 13, 3]. In Chen and Li [24], group identity modifies social preferences: subjects are more generous, more altruistic and less envious towards ingroup members and they maximize the social welfare more when interacting with ingroup members. Bornstein et al. [15] find that, in the centipede game, groups show stronger concerns for team payoff (despite leading them to act closer to the rational solution, exiting earlier from the game and getting a lower payoff). Being in a group makes you feel responsible for

[13]For references from psychology and sociology see the survey by Hewstone et al. [43].

others' payoff, it seems people value the profit of other group members even more highly than their own. In Babcock et al. [7], the team compensation system induces agents to choose the level of effort as if they valued a marginal dollar of compensation for their team-mate from two-thirds to twice as much as a dollar for themselves. Conrads et al. [25] show how under team incentives, being responsible of somebody else's payoff increases lying, even though the marginal incentive to lie is lower: with team incentives subjects earn only half of the "profit of their lie", the other half of the profit goes to their team-mate.

If subjects are altruistic and show ingroup bias, when deciding (also) for their group-mates their focus on payoff will be higher than when deciding for themselves. $x_i + y_i > 0$ (which leads to the non socially responsible choice) for a smaller range of values of x and y than $\alpha_i x_j + y_i$ and $x_i + (n-1)\alpha_i x_j - n y_i$. It is predicted subjects purchase less SR products and care more about the monetary gain when deciding for another group-mate only, relative to the 'C - C'.[14] It is also predicted that willingness to pay for socially responsible product (WtpSR) is lower in treatments where payoff is collective and the product is selected for the group. Less ecological gloves are selected in the 'I - C' treatment relative to the 'I - I', less ecological gloves in group-mate and in the 'C - C' relative to the 'C - I' treatment.

Hypotesis 3. *If participants show ingroup bias, $\alpha_i > 1$ and they focus more on monetary gain when deciding for group-mates and when deciding for their group in the 'C - C' and 'I - C' treatments:*

$$\textit{WtpSR Collective Payoff} < \textit{WtpSR Individual Payoff}$$

$$\textit{WtpSR Group-mate Payoff} < \textit{WtpSR Individual Payoff}$$

[14] If farmers have a perfect altruism ($\alpha_i = 1$), the decision for himself and for a team-mate in the 'C - C' should be the same.

Moral wiggle room and Self-Serving altruism

It is well known people prefer achieving a socially responsible self image [17, 11, 12]. Research on behavioural ethics shows many unethical acts are committed with people knowingly manipulating ethical rules in a self-serving fashion (see Shalvi et al. [64] for a framework centred on the role of self-serving justifications for unethical behaviour). Many studies show the existence of these self-serving biases [6]. In Gino et al. [39] subjects cheat more when there is a group profiting from their cheating, but cheating is even higher if they also can personally benefit from the unethical action. Deciding not only about own profits but also about profits of other people can create the moral wiggle room for subjects to act in a non-socially responsible way (focusing on the monetary gain) with the excuse of being interested in the profits of their group-mates, without having to feel non-socially responsible [26, 5]. The guilt for acting non-socially responsibly is hence diffused, with people acting in a non-socially responsible way without loosing their socially responsible image, exploiting the moral wiggle room to behave selfishly.

If guilt diffuses for self-serving motives when deciding not only for the self, $\gamma_i > 1$ and the total cost from producing the negative externality reduces when deciding for a group. Subjects have a higher focus on monetary gains when deciding for not only themselves but for the group even if $\alpha_i < 1$. Here, subjects care less about group-mates monetary gain if their gain is not involved, purchasing more socially responsible expensive products when deciding for others only, but fewer socially responsible products when their gain is also involved. It is predicted that willingness to pay for socially responsible product (WtpSR) is high when deciding for a group-mate (as in 'I - I' and 'C - I' or higher), but lower when also own payoff is involved.

Hypotesis 4. *If participants show self-serving altruism, they focus on monetary gain under payoff commonality, but not when deciding only for another group-mate:*

WtpSR Collective Payoff < WtpSR Individual Payoff

WtpSR Group-mate Payoff > WtpSR for Individual/Collective Payoff

1.3.5 Donation Decision

Scores on the GREEN scale [41] and the use or production of socially responsible products in the farm should have a positive correlation with donations (the willingness to pay for the donation), if all measure the social responsibility of the participant.

Some studies show that people with a higher position at work have lower moral reasoning [70, 68, 71], therefore I expect that the higher the number of years in business, size and earnings of the farm, the lower the social responsibility and the willingness to donate to charity in the study.

As discussed in section 1.2.2, group decision making and sharing consequences of the decision might lead to more non-socially responsible behaviour. If continued non-socially responsible behaviour outside the lab spills over to individual situations, I expect the number of decision makers and stakeholders of the farm to influence the individual level of social responsibility in the experiment, observed in the donation decision.

1.4 Results

1.4.1 Non Parametric Results

This section shows the non-parametric estimates comparing the average willingness to pay for ecological gloves across treatments (figure 1.4.1). Subjects are willing to pay on average 13.47 €for the the ecological working gloves, which means their

willingness to pay for the socially responsible product is positive and behaving non-SR carries a cost ($y_i \neq 0$). Table 1.4.1 reports the p-values based on a two-sample Mann-Whitney test, comparing each treatment with 'I - I' in column (3), and 'C - I' in column (4).

Wtp for the ecological gloves when deciding by majority in 'C - I' treatment, is not significantly different from 'I - I' and group-mate, nor in 'C - C' treatment from 'I - C'. This shows $\delta_i = 1$, the cost of taking a non-socially responsible action does not diffuse in this contest. In 'C - C' and 'I - C' treatments, where the payoff and the benefits of the choice are collective, the willingness to pay for the socially responsible product is significantly lower and the focus is instead on monetary gains. Either subjects have a particular care over group-mate payoff ($\alpha_i > 1$), or in groups it is easier to justify you are acting non socially responsibly in the interest of the group ($\gamma < 1$). Deciding for a group-mate does not lead to a different WtpSR than when deciding for own payoff in the 'C - I' treatment. Subjects focus on payoff when deciding for the group but not when deciding for a group-mate. This shows the lower social responsibility when deciding for the group in the 'I - C' and 'C - C' treatments is not led by altruistic reasons ($\alpha_i \leq 1$).

The non-parametric analysis shows that subjects have social preferences and taking non socially responsible actions carries a cost. Deciding in group does not diffuse responsibility, not modifying the social responsibility of the choice. Deciding for a group with collective payoff and benefits induces a focus on the monetary gain and reduces the social responsibility of choices, because it creates the moral wiggle room for subjects to focus on payoff while feeling socially responsible.

Table 1.4.1: Willingness to pay for ecological gloves (WtpSR)

	(1)	(2)	(3)	(4)
	Mean	Sd	p-value vs (I - I)	p-value vs (C - I)
I - I	15.867	6.684		0.8336
C - I	14.71	7.542	0.8336	
Group-mate	15.548	7.37	0.7885	0.6582
I - C	11.355	8.616	0.0250	0.0426
C - C	9.935	8.981	0.0095	0.0131
Total	13.467	8.148		

P-values based on a two-sample Mann-Whitney test.

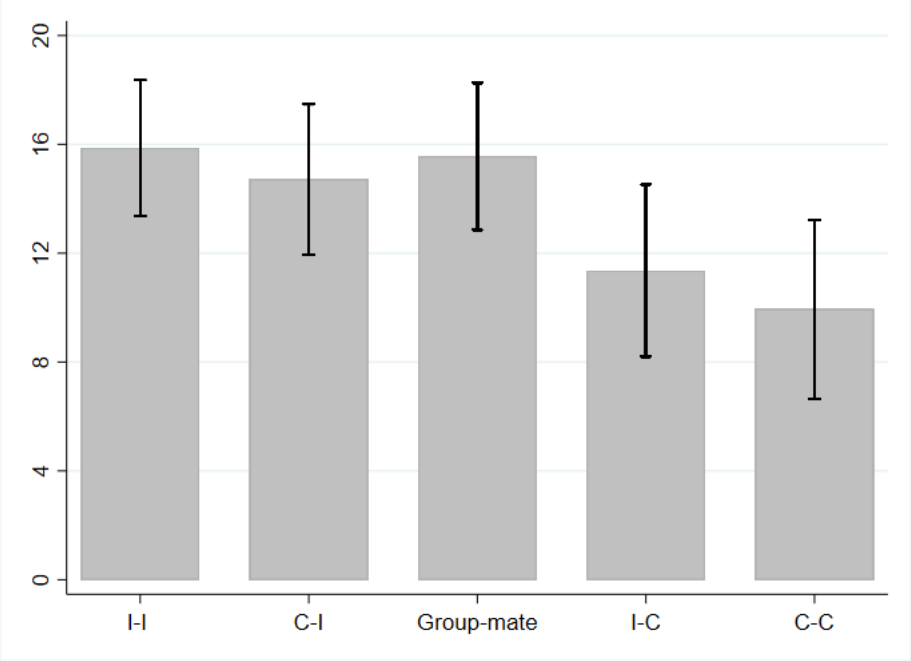


Figure 1.4.1: Mean willingness to pay for ecological gloves (WtpSR) in each treatment.
Mean of the WtpSR for each group. Valuation measured on a scale from 2 to 20 euro. Error bars reflect +/- 1 standard error of the mean.

I graph the percentage of subjects choosing different switch-points between choosing ecological gloves (SR) and choosing the non-ecological but 'profitable' gloves (non SR). Figure 1.4.2 histograms the Wtp for the ecological gloves of all subjects

for each treatment. In 'I - I, ''C - I' and 'group-mate', where benefits of the non socially responsible choice are not collective, a substantial fraction of subjects refuses to select and receive the non ecological product for any bonus and none chooses the non-ecological but 'profitable' option in all the 10 decisions. In 'I - C' and 'C - C' treatments instead, where payoff is collective, more than 20% of subjects always prefer the non-socially responsible option, confirming that having other subjects also benefiting from the non-SR decision modifies social responsibility.

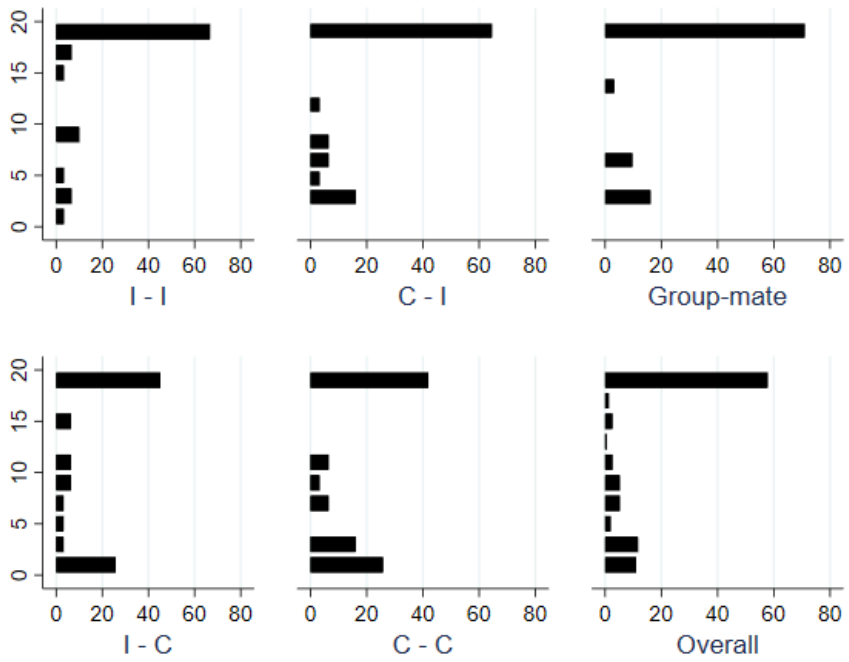


Figure 1.4.2: Willingness to pay for social responsibility by group
Percentage of subjects with different willingness to pay for the ecological gloves by treatment.

Moving to the willingness to donate, the average willingness to donate is not significantly different across treatments. Figure 1.4.3 show the distribution of participants' willingness to donate. Around 50% of subjects prefer to donate over receiving any sum of money.

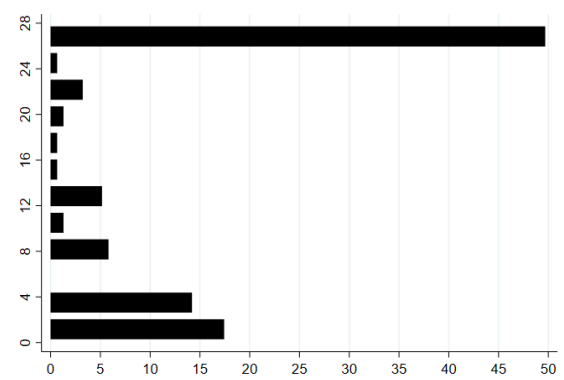


Figure 1.4.3: Willingness to donate

Percentage of subjects with different willingness to donate.

1.4.2 Regression results

I estimate a Tobit model for the willingness to pay for the socially responsible product. I use a Tobit model since the Wtp is censored between 0 and 20 €and several subjects cluster at the limits. In columns (1) and (2) I analyse the effect of collective decision making and collective payoff on social responsibility, by including a dummy for each of the two dimensions and their interaction. Here the decision for the group-mate only is not included. In columns (3) and (4) I analyse the effect of each treatment on social responsibility, including the decision for only the group-mate. Column (2) and (4) show the augmented model, which includes controls for several characteristics of the farm and farmer and a session fixed effect. The Tobit model echoes the results from the non-parametric analysis. In appendix 1.5.5 I report the OLS analysis. The pattern of significance is the same, but discarding the censored nature of the data leads to smaller coefficients on the treatments, reducing the magnitude of the effect of payoff commonality.

Collective decision making by majority does not change the willingness to pay for the socially responsible product. Collective payoff increases the focus on monetary gains, in both 'I - C' and 'C - C' treatments subjects switch to choosing the non-ecological

but profitable option for a lower monetary bonus. Deciding for a group-mate only ('Group-mate') in the 'C - I' treatment does not change significantly the willingness to pay for the ecological product, confirming the hypothesis of self-serving altruism when deciding for collective payoff. In treatments with collective payoff subjects switch to selecting the non-SR good for a bonus 13 €lower than when deciding for themselves (17 euro lower if I control for the farm and farmer's characteristics and include session fixed effects). The interaction between collective decision making and collective payoff does not modify willingness to pay for the socially responsible product further. The measure of social responsibility I collect in the lab (willingness to pay for the ecological gloves) is correlated with the willingness to donate and is externally valid, correlating with the greenness of the farmer and the farm. The number of employees and decision makers in the farm does not influence the willingness to pay for the socially responsible product instead.

I also analyse the relation between the characteristics collected in the survey and the individual donation decision with a Tobit model (table 1.5.5). The average willingness to donate is 17.13 and is influenced by the number of decision makers in the farm. While having to decide for more subjects (a higher number of employees) leads to slightly less donations (in line with the result that sharing consequences of the choice leads to fewer SR choices), a higher number of decision makers in the farm increases the willingness to donate. As for the other characteristics, older subjects donate slightly more and farmers with a higher Greenness score or whose farm produces a socially responsible product donate significantly more.

When eliciting willingness to pay with the help of a price list, there is the possibility of subjects switching multiple times between the two options. 9% of subjects switches multiple times in the product decision, 1% when deciding about the

Table 1.4.2: Tobit model of Willingness to pay for the Socially Responsible product

	(1) WtpSR	(2) WtpSR	(3) WtpSR	(4) WtpSR
Two dimensions				
Collective Decision	-0.911	2.061		
	(0.877)	(0.719)		
Collective Payoff	-13.62**	-17.70***		
	(0.021)	(0.005)		
Collective Decision*Payoff	-0.809	2.417		
	(0.919)	(0.761)		
Treatments (baseline: I - I)				
C - I			-0.907	2.445
			(0.878)	(0.645)
Group-mate			2.068	6.542
			(0.732)	(0.247)
I - C			-13.68**	-17.39***
			(0.020)	(0.003)
C - C			-15.40***	-14.65***
			(0.009)	(0.004)
Control variables				
i.Session		yes		yes
		(.)		(.)
Willingness to donate		0.664***		0.709***
		(0.000)		(0.000)
Years in business		-0.465***		-0.485***
		(0.008)		(0.001)
N. of employees		-0.374		-0.311
		(0.394)		(0.428)
N. of decision makers		-0.251		-0.432
		(0.897)		(0.809)
Yearly revenues		2.040		2.102*
		(0.117)		(0.070)
Locally produced		0.915		0.534
		(0.828)		(0.883)
Organic product		-5.672		-6.475*
		(0.218)		(0.100)
Buy organic		7.114		7.819*
		(0.158)		(0.076)
Greenness score		4.223*		4.949**
		(0.066)		(0.013)
Female		-2.385		-1.421
		(0.584)		(0.716)
Age		0.201		0.197
		(0.316)		(0.265)
Constant	27.17***	-18.49	27.25***	-21.38
	(0.000)	(0.290)	(0.000)	(0.153)
Observations	123	103	154	131

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.4.3: Tobit regression of the Willingness to Donate

	(1) WtpD	(2) WtpD
Dimensions I vary experimentally		
N. of decision maker	3.859	9.109**
	(0.164)	(0.025)
N. of employees	-0.388	-1.028
	(0.527)	(0.140)
Control variables		
i.Session		yes
		(.)
Years in business		0.314
		(0.245)
Yearly revenues		-0.262
		(0.882)
Locally produced		6.009
		(0.311)
Biological product		21.35***
		(0.002)
Buy biological		-8.653
		(0.212)
Greenness score		7.519**
		(0.025)
Female		3.799
		(0.570)
Age		0.497*
		(0.070)
Constant	18.35***	-58.49**
	(0.001)	(0.024)
Observations	118	103

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

product for a group-mate and 12% in the donation choice. In order to ensure multi-switchers do not affect results, I test for robustness using different measures of Wtp for multi-switchers. All the analysis presented uses the first switch-point, excluding multi-switchers from the analysis does not significantly affect results (the Tobit models for the willingness ot pay for the ecological gloves and the willingness to donate excluding multi-switchers are in Appendix 1.5.6).

1.4.3 Checks

Before the product decision, I ask some control questions on the decision and payment mechanisms. The decision mechanism in the 'C - I' treatment was the hardest to understand, with around 80% of subjects understanding it (details in Appendix 1.5.4, table 1.5.2).

In the survey I ask farmers about the different influences on the choice between ecological and non-ecological gloves. They report the main influences to be the ecological quality of the gloves (mean score of 5.28 on a likert scale from 1 = no influence at all; to 7 = huge influence), followed by the social responsibility of production (score of 5.05). The actual quality of the gloves influences the decision to a lower extent (score of 4.40), while farmers report that the possibility of earning a bonus has a very small influence on their selection (score of 2.87).

I ask farmers about my measures of social responsibility: subjects consider not donating and choosing the non-ecological gloves plus the monetary bonus as non-socially responsible (mean score of around 3.5 for both behaviours, on a likert scale from 1 = not socially responsible; to 7 = very socially responsible). I also calculate the correlation between my measures of socially responsible behaviour, willingness to pay for the socially responsible product, willingness to donate and the other measures of ethical behaviour collected in the survey (i.e. the greenness score, beliefs on the

social responsibility of non-donating and purchasing non-ecological gloves and the ethical characteristics of the farm). There is a low correlation between the measures in general, with the exception of a medium correlation between the two willingness to pay. The correlation table is in Appendix 1.5.4, table 1.5.3.

1.5 Conclusion

This study with farmers improves the understanding of producers' socially responsible choices. First, complementing research on group decision making by separating the impact of collective decision making and collective payoff on socially responsible behaviours. In line with the literature, groups show lower social responsibility [22, 35, 46, 45]. Collective decision making by majority does not affect choices, showing how diffusion of responsibility does not depend simply on collective decision making. Being responsible for the payoff of a group of subjects instead increases the focus on payoff and reduces social responsibility. This study allows us to show that the motive behind the lower social responsibility is not ingroup bias and altruistic interest towards the payoff of ingroup members. Instead, deciding for a group creates the moral wiggle room for subjects to choose the monetary gain while feeling socially responsible, showing self-serving altruism in line with Babcock and Loewenstein [6], Gino et al. [39], Shalvi et al. [64]. Indeed when deciding for another group member only, subjects do not have a higher focus on payoff and "remain" socially responsible. Only when their payoff benefits as well from the non socially responsible choice, in case of payoff commonality, there is a decrease in social responsibility.
Second, this paper improves the understanding in corporate socially responsible choices by providing evidence on actual producers. Producers social responsibility has previously been studied in experiments with students, using fictitious goods

in a laboratory setting. This study instead offers new evidence on the willingness to pay of farmers, owners of a company, for a socially responsible product for their company in a "familiar" setting.

More research is needed to study the impact of the two dimensions of collective decision making and collective payoff on social-responsibility in the lab, including a between subject comparison of the decision for a group-mate only. Moreover, collective decision making in the experiment happen in condition of full anonimity and without communication, making it important to study the impact of this dimension in case of communication between subjects and including reputation concerns. In the product decision, the relative small price relevance of the gloves on the production might induce a higher level of social responsibility, though the comparative statics of the behaviour between treatments remain relevant.

These findings could also provide important insights for the design of organisations and institutions. When having to take decisions that benefit also their ingroup, subjects behave in a less socially responsible way by exploiting the moral wiggle room created by having to care for their ingroup. While caring for the stakeholders is an important feature, it may also lead to high costs for the society. With the goal of having corporations internalizing their negative externalities, a first important step would be to make salient to decision makers how social responsibility is relevant for the people they decide for. Running surveys among employees to then report their preference for social responsibility in their corporation to the board of directors is a first step to take. In organisations that also share payoff and profits, it might then be necessary to create a stronger code of conduct to limit non socially responsible behaviours. Several studies have shown that increasing the salience of the ethical

code and giving the opportunity to achieve a certification decreases the room for justifying unethical behaviours [57, 27, 65], so more interventions on this should be tested.

Appendix

1.5.1 Confederazione Italiana Agricoltori (CIA)

CIA was formed in 1977 and is, together with Confagricultura, one of the main union of the agricultural sector in Italy, representing 900, 000 farmers. CIA works for the improvement and enhancement of the primary sector and for the protection of the conditions of its employees. It provides information on all major policy and legislative matters that might affect the businesses of its members and offers a wide range of services. CIA offers legal advice to ensure compliance with all tax provisions, legal help with complying to all norms to set up an enterprise and advice on the best business form to adopt. It also provides business and administrative consultancy, by helping formulating a business plan and a strategy, and accounting consultancy. CIA head office is in Rome, the union is part of the European agricultural union (Committee of Professional Agricultural Organisations, COPA) and of the World Farmers' Organisation (WFO). It is organised locally in regional and provincial associations with legal autonomy. In Tuscany, where I run the experiment, it has a total of 18,544 farmers affiliated.

Table 1.5.1: Affiliates by area and age

	Affiliates per Age Group					**Tot. per Area**
	<40	41 - 50	51 - 65	>65	Businesses	
Firenze Prato	152	246	468	903	181	1950
Arezzo	195	279	784	1102	159	2519
Grosseto	326	565	1247	1564	511	4213
Livorno	80	145	323	578	62	1188
Pisa	100	129	430	696	87	1442
Pistoia	154	227	452	499	91	1423
Siena	452	478	1120	1708	386	4144
Lucca Massa Carrara	166	233	478	760	28	1665
Tot. per age group	1625	2302	5302	7810	1505	18544

1.5.2 Recruitment Material

This section shows a translated version from Italian of the recruitment material.

Entrepreneurial Choices

We would like to invite the producers of your association to take part in a research study funded by the ***School of Economics of the University of Edinburgh****.*

1. WHAT IS THE STUDY ABOUT?

This project aims at studying the decisional mechanism of producers. The study is going to last around 45 minutes, and it is going to consist of two parts. In both parts, producers will have to take decisions with a budget we will provide. In the first part, they will take purchase choices for the association with the budget and will have the chance to earn some money. In the second part, they will decide about donating to charity or allocating a budget to themselves. We will also ask producers some questions regarding their business and the study.

2. DEVELOPMENT

To run the study we would need a room next to where the association meeting happens where to reunite the producers for around 45 minutes. We would like to run the study at the beginning or at the end of your meetings, according to your availability.
The study will happen in pen and paper. We will ask each participant to take his decisions without communicating with the others, in groups of 30 employers max at a time. We will invite all the producers attending your meetings to participate and the participation will be voluntary and compensated.

3. OPEN ISSUES

3.1 Product

We would need to define the product producers will buy. Do you have any preference/advice?
The product we will offer has to have the following characteristics:

- Be useful to the productive process of the confederation (for example ink for the printers, advertisement material)
- Have an ethical component (for example ecological or non-ecological ink, fair trade or non-fair trade coffee)
-

3.2 Schedule of the sessions

We aim at running the experiment in the period November 2017 – May 2018. We would like to get a sample of 150 producers. When would you be available to let us participate to your meetings?

4. CONFIDENTIALITY/ANONYMITY

We will not disclose the result of the decisions to the other participants in the study. We will store all the information we collect from safely and securely and in accordance with our data protection guidelines. During the whole project duration, we will give producers an identifier (a number). This allows us to keep **all the information anonymous in our data: t**he data we collect will not contain any identifying information except for a file that links names to numerical identifiers (this is just to be able to give them the compensation at the end of the session). Once the name will be replaced with a number identifier, it will not be possible for anyone else using this data to identify subjects.
All the information provided us will be made anonymous and will only be used for scientific research purposes. We will share the results of the research will be shared with the Consortium when the study will be over.

PhD student Martina Vecchi
School of Economics
University of Edinburgh

Prof. Dr. Michèle Belot
Department of Economics
European University Institute

Figure 1.5.1: Letter to the Directors

Entrepreneurial Choices

*We would like to invite you to take part in a research study funded by the **School of Economics of the University of Edinburgh**. By signing this form, you agree to participate in the study. Please take the time to read the following information on this study carefully, before deciding to take part.*

WHAT IS THE STUDY ABOUT?

This project aims at studying the decisional mechanism of producers. The study is going to last around 1 hour, and it is going to consist of two parts. In both parts, you will have to take decisions with a budget we will provide you. In the first part, you will have the chance to take purchase choices and have the chance to earn some money. In the second part, you will decide about donating to charity or allocating a budget to yourself. We will also ask you some questions regarding your preferences, your business and this study.

CONFIDENTIALITY/ANONYMITY

The result of your decisions will not be disclosed to the other participants in the study.
During the whole duration of the project, you will be given an identifier (a number). This allows us to keep **all your information anonymous in our data:** the data we collect will not contain any identifying information except for a file that links names to numerical identifiers (this is just to be able to give you your compensation at the end of the session and to send you what you purchased). Once your name is replaced with a number identifier, it will not be possible for anyone else using this data to identify you. By agreeing to take part, you agree to your anonymised data being retained by the individual researcher for analysis. We will store all the information we collect, including a digitalised version of the paper trail, safely and securely in accordance with the data protection guidelines of the University of Edinburgh. You can find more information on the website:
http://www.ed.ac.uk/information-services/about/policies-and-regulations/research-data-policy
All the information you will provide us will be made anonymous and will only be used for scientific research purposes. The results of the research will be shared with you and the consortium at the conclusion of the study.

Please note that participation in this study is **entirely voluntary** and given by signing the consent form attached. You are free to withdraw at any time, without giving a reason. You have the right to omit or refuse to answer or respond to any question and without any penalty. If you have any questions after reading this information sheet, you should ask the researcher before the study begins.

Please do not hesitate to contact us if you have any questions about the project. My contact details are as follows:

Martina Vecchi, PhD student at the University of Edinburgh, martina.vecchi@eui.eu

PhD student Martina Vecchi
School of Economics, University of Edinburgh

STUDY "ENTREPRENEURIAL CHOICES"

Please give us your email so we can send you a confirmation of the purchase/money distribution:

Email _____

Informed Consent Form

1. I confirm that I have read and understood the information sheet (as specified in this document header) for the above study and have had the opportunity to consider the information and ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. ☐
3. I agree to take part in the study "Entrepreneurial Choices" ☐

Date _____ Signature _____

Figure 1.5.2: Informed Consent for Producers

1.5.3 Green scale

In the experiment, I measure the greenness score as the average score of the 6 questions part of the GREEN score developed by Haws et al. (2014). The questions on the scale are reported here below.

On a scale from 1 (strongly disagree) to 7 (strongly agree), how much do you agree with each of the following statements:

1. It is important to me that the products I use do not harm the environment.
2. I consider the potential environmental impact of my actions when making many of my decisions.
3. My purchase habits are affected by my concern for our environment.
4. I am concerned about wasting the resources of our planet.
5. I would describe myself as environmentally responsible.
6. I am willing to be inconvenienced in order to take actions that are more environmentally friendly.

1.5.4 Supplementary materials

Before taking the decision between ecological and non ecological gloves, subjects were asked some control questions about their understanding of the decision mechanism (whether their decision was made in a group or individually and whether the decision had consequences for the group or only the individual) and of the mechanism of selection (only 1/3 of subject and 1 decision every 10 was implemented). The table below reports the number of subjects responding correctly to all the control questions (correct), the number of people responding correctly only to the questions about the decision mechanism (correct decision mechanism) and the number of people answering non correctly to both parts (not correct).

Table 1.5.2: Understanding of the decision making mechanism

		Treatments				
		I - I	I - C	C - I	C - C	Total
Correct	N. of sbj	25	23	18	27	93
	%[b]	89.29	71.88	62.07	84.38	74.00
Correct decision mechanism [a]	N. of sbj	1	6	6	3	16
	%[b]	3.57	18.75	20.69	9.38	14.67
Not Correct	N. of sbj	2	3	5	2	12
	%[b]	7.14	9.38	17.24	6.25	11.33
Total	N. of sbj	28	32	29	32	121
	%[b]	100.00	100.00	100.00	100.00	100.00

[a] Incorrect answers refer to the drawing mechanism of selection of participants and decision pair to implement, not to the decision making mechanism (individual or group payoff and decision).

[b] Percentage of farmers answering in a correct, partially correct, incorrect way to the control questions.

Table 1.5.3 reports the correlation betweeen the variables measuring social responsibility, both the decision variables (Wtp for SR and Wtp for donation) and the survey variables.

Table 1.5.3: Correlation Between Variables

	(1)							
	Wtp for SR	Wtp for donation	Greenness score	SR of non SR	SR of non-donating	Locally produced	Organic product	Buy organic
Wtp for SR	1							
Wtp for donation	0.419***	1						
Greenness score	0.289***	0.292***	1					
SR of choosing non SR	-0.191*	0.0453	0.0837	1				
SR of non-donating	0.105	0.0693	0.0238	0.428***	1			
Locally produced	0.126	0.175*	0.0715	-0.106	-0.160	1		
Organic product	0.123	0.288***	0.181*	-0.122	-0.0620	0.305***	1	
Buy organic	0.208**	0.0974	0.297***	-0.0229	0.0261	0.408***	0.351***	1
Others' ethicality	0.0501	0.144	-0.0394	0.220**	0.200*	0.0768	0.0909	-0.0292

A Pearson's coefficient $0.1 < |r| < 0.3$ indicates small correlation, $0.3 < |r|$ ¡ 0.5 medium and $|r| > 0.5$ strong correlation.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1.5.5 OLS regression models

Table 1.5.4 below reports the OLS models for the effect of collective decision making and collective payoff on social responsibility of choices in the decision between ecological and non ecological gloves. As in the Tobit model presented in the main text, collective payoff significantly reduces the social responsibility of choices while collective decision making does not modify social responsibility.

Table 1.5.5 reports the OLS model for the impact of the farm and farmers' characteristics on the willingness to donate to charity. As in the Tobit model reported in the main text, the number of people with decisional power in the farm, the greenness score and whether the farm produces an organic product are positively related to the willingness to donate.

Table 1.5.4: OLS regression of Wtp for SR

	(1) WtpSR	(2) WtpSR	(3) WtpSR	(4) WtpSR
Dimensions				
Collective Decision	-1.157	-1.158		
	(0.527)	(0.564)		
Collective Payoff	-4.512**	-5.642**		
	(0.024)	(0.026)		
Collective Decision*Payoff	-0.262	0.986		
	(0.928)	(0.763)		
Treatments (baseline: I - I)				
C - I			-1.157	-1.056
			(0.527)	(0.579)
Group-mate			-0.318	-0.127
			(0.860)	(0.944)
I - C			-4.512**	-5.456**
			(0.023)	(0.020)
C - C			-5.931***	-6.273***
			(0.004)	(0.003)
Control variables				
i.Session		yes		yes
		(.)		(.)
Wtp for donation		0.281***		0.300***
		(0.001)		(0.000)
Years in business		-0.187**		-0.207***
		(0.013)		(0.001)
N. of employees		-0.218		-0.210*
		(0.114)		(0.055)
N. of decision makers		-0.191		-0.275
		(0.751)		(0.606)
Yearly revenues		0.458		0.503
		(0.349)		(0.192)
Locally produced		-0.268		-0.646
		(0.900)		(0.719)
Organic product		-1.917		-2.340
		(0.313)		(0.112)
Buy organic		1.897		1.934
		(0.266)		(0.161)
Greenness score		1.373		1.627**
		(0.137)		(0.022)
Female		-1.032		-0.663
		(0.589)		(0.690)
Age		0.0702		0.0711
		(0.270)		(0.183)
Constant	15.87***	2.787	15.87***	2.028
	(0.000)	(0.692)	(0.000)	(0.710)
Observations	123	103	154	131

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.5.5: OLS regression of WtpD

	(1) WtpD	(2) WtpD
Dimensions I vary experimentally		
N. of decision maker	1.198**	2.215*
	(0.013)	(0.060)
N. of employees	-0.0952	-0.361
	(0.687)	(0.116)
Control variables		
i.Session		yes
		(.)
Years in business		0.0890
		(0.302)
Yearly revenues		0.354
		(0.687)
Locally produced		4.172
		(0.146)
Organic product		7.883***
		(0.004)
Buy organic		-3.428
		(0.220)
Greenness score		2.665*
		(0.073)
Female		2.366
		(0.383)
Age		0.197*
		(0.096)
Constant	20.26***	-13.19
	(0.000)	(0.228)
Observations	118	103

p-values in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
p-values below 0.1 in bold.

1.5.6 Regression analysis excluding multi-switchers

The two tables below report respectively the Tobit model of the impact of collective decision making and collective payoff on willingness to pay for the socially responsible product (table 1.5.6) and the Tobit model for the impact of farm and farmers' characteristics on willingness to donate (table 1.5.7) excluding subjects switching multiple times between behaving socially responsibly and not.

Table 1.5.6: Tobit model of Wtp for SR gloves excluding multi-switchers

	(1) WtpSR	(2) WtpSR	(3) WtpSR	(4) WtpSR
Dimensions				
Collective Decision	-2.920	-8.100		
	(0.626)	(0.148)		
Collective Payoff	-10.28*	-15.81**		
	(0.097)	(0.016)		
Collective Decision*Payoff	-1.703	5.681		
	(0.838)	(0.476)		
Treatments (baseline: I - I)				
C - I			-2.925	-6.787
			(0.627)	(0.161)
Team-mate			-0.482	-3.349
			(0.938)	(0.504)
I - C			-10.34*	-14.64***
			(0.096)	(0.010)
C - C			-14.97**	-19.06***
			(0.016)	(0.000)
Control variables				
i.Session		yes		yes
		(.)		(.)
Wtp for donation		0.751***		0.790***
		(0.000)		(0.000)
Years in business		-0.524***		-0.514***
		(0.001)		(0.000)
N. of employees		-0.314		-0.252
		(0.384)		(0.423)
N. of decision makers		0.449		0.0888
		(0.778)		0.950)
Yearly revenues		2.223*		2.303**
		(0.060)		(0.027)
Locally produced		-11.58***		-9.774***
		(0.010)		(0.008)
Organic product		-1.534		-1.534 -0.271
		(0.659)		(0.659) (0.948)
Buy organic		10.92**		10.63***
		(0.025)		(0.010)
Greenness score		4.407**		4.821***
		(0.031)		(0.005)
Female		-9.484**		-8.550**
		(0.021)		(0.018)
Age		-0.00548		0.0185
		(0.977)		(0.907)
Constant	19.03***	9.895***	19.15***	9.130***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	112	93	142	120

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.5.7: Tobit regression of Wtp for donation excluding multiswitchers

	(1) WtpD	(2) WtpD
Dimensions I vary experimentally		
N. of decision makers	3.738	9.890**
	(0.197)	(0.027)
N. of employees	-0.396	-1.379*
	(0.531)	(0.060)
Control variables		
i.Session		yes
		(.)
Years in business		0.384
		(0.168)
Yearly revenues		1.317
		(0.489)
Locally produced		10.06
		(0.117)
Organic product		22.08***
		(0.003)
Buy organic		-7.238
		(0.315)
Greenness score		4.441
		(0.212)
Female		6.382
		(0.368)
Age		0.623**
		(0.038)
Constant	20.08***	-49.49*
	(0.001)	(0.071)
Observations	107	93

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Instructions

This section reports the instructions of the experiment translated from Italian. The introduction, part two and the questionnaire are common to all four treatments and are reported only once in 1.5.7, 1.5.12 and 1.5.13. The overview and first part are reported for each treatment.

1.5.7 Introduction - Common to all Treatments

THANK YOU VERY MUCH FOR PARTICIPATING IN THE STUDY!

Instructions With your participation, you have the chance of taking a decision about receiving a product for your farm, making a donation and earning an amount of money.

Your anonymity is ensured: other participants will not know your decisions in this experiment. At the end of the session, you will receive your money from a researcher who is not present in the room. Neither the other participants nor the researchers will be able to see how much money you have earned.

Please note: Throughout the whole session, we ask you to not use your phone or communicate with each other. Communication between the participants is not allowed.
If you have any questions please raise your hand. Your question will then be answered at your seat. All statements made in these instructions are true and your decisions will be implemented in the way we describe below if you are selected.

Overview of the Experiment

1. **Part One**

   You have the chance to take a decision for your farm. You will choose which product to receive between two alternatives, an ecological one and one without the ecological quality which allows you to receive also a varying payment. We ask each of you to take several decisions for different amounts of the payment additional to the non ecological product, but only one of those decisions will be randomly selected and implemented. In this part only 1

every 3 of you will be randomly selected to have their choice implemented. All the draws will be done by one of you at the end of the session by drawing a number from a bag.

2. **Part Two**

   Each of you will take 15 decisions between two alternatives X and Y. We will then draw a number from 1 to 15 and implement the choice for that decision pair for those of you not selected in Part One.

3. **Questionnaires**

   We will ask you to answer some questions about your firm and your experience in this study.

1.5.8 'I - I' Treatment - Individual decision and payoff

Beginning of the Study - Part One

You have to decide about receiving a **product for your farm.**
You have to take 10 decisions. We ask you to decide between the alternatives for each decision pair by ticking the box close to the preferred alternative.
Each of you will have to take the following decisions about the product and your gain. We will select at random **1 every 3 of you**, his decision will be implemented and will determine his earnings. **Of the 10 decision pairs, only 1 will be implemented** according to your decision, if you are selected.
If you are not selected (2 every 3 of you are not selected), none of your choices will be applied and you will not gain anything in this first part.

Recap:

1. ***You take 10 decisions about the product and the payoff.***
2. *1 every 3 of you is selected.*
3. *1 every 10 decision pairs is drawn.*
4. *The preferred alternative (A or B) in the decision pair drawn determines the product you receive and the gains of the selected person.*

You have to decide between receiving **two types of working gloves** for your farm at different conditions. You will receive a pairs of the gloves you selected. The two gloves fulfil the same function and the two types are:

A "ECOLOGICAL WORKING GLOVES":

Bamboo working gloves, made of sustainable bamboo.

Bamboo is one of the fastest growing plants in the world.

Bamboo is a natural product that grows without any pesticides or fertilizers.

Bamboo is completely biodegradable, using it in the productive process instead of synthetic fibers it helps reducing waste.

Produced in sweatfree plants.

Excellent abrasion resistance.

B "NON ECOLOGICAL WORKING GLOVES":

Nylon working gloves, made in nylon knit.

Nylon is one of the most used man-made synthetic fiber.

Nylon is made from petrochemicals introduced as an early substitute for silk.

Excellent abrasion resistance.

This is an example of the decisions you will face

DECISION PAIR 1	A: Buy the ECOLOGICAL gloves and **you get 0 euro**	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and **you get 3 euro**	☐
DECISION PAIR 2	A: Buy the ECOLOGICAL gloves and **you get 0 euro**	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and **you get 18 euro**	☐

The 10 decision pairs are listed on the next page. **The alternative A does not vary while the gain in alternative B varies for each decision pair.**

Please tick the box next to the choice you prefer for **each of the 10 decision pairs**. In total, you will have to cross 10 boxes.

If you are selected, your choice for the decision pair drawn will be implemented and will determine your gains.

*If **for example** decision pair 2 is selected and you marked alternative A, we will buy a pair of the the ECOLOGICAL GLOVES for your farm and you will receive no payment. If you selected alternative B, we will buy a pair of the the NON ECOLOGICAL GLOVES and the experimenter in the next room will put 18 euro in the envelope you will receive when leaving the experiment.*

The gloves you choose will be sent to your farm by courier at the address you gave us in the consent.

Comprehension questions

Select the box corresponding to the correct answer. Please raise your hand if you have any doubt about the correct answer.

How many people will take the decision about the product and your gain with you, if you are selected, in this first part (you included)?

0	2	6

How many people will share potential payoff with you, in this first part?

0	6	2

How many people will we draw in this first part?

Everybody	1 every 3 of you	2 every 3 of you

How many decisions do you have to take (total number of boxes that you will have to cross) ?

20	10	1

How many decision pairs will we then draw and implement, for the people selected?

2	1	10

SELECT THE BOX CORRESPONDING TO THE PURCHASE DECISION YOU PREFER FOR EACH DECISION PAIR (ONLY ONE BOX PER DECISION PAIR)

DECISION PAIR 1	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **2 euro** ☐
DECISION PAIR 2	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **4 euro** ☐
DECISION PAIR 3	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **6 euro** ☐
DECISION PAIR 4	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **8 euro** ☐
DECISION PAIR 5	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **10 euro** ☐

DECISION PAIR 6	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **12 euro** ☐
DECISION PAIR 7	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **14 euro** ☐
DECISION PAIR 8	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **16 euro** ☐
DECISION PAIR 9	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **18 euro** ☐
DECISION PAIR 10	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **20 euro** ☐

1.5.9 'I - C' Treatment - Individual decision and collective payoff

Beginning of the Study - Part One

You have to decide about receiving a **product for your farm and the farm of 2 other farmers** (another 1 if we do not have enough participants).

You have to take 10 decisions for yourself and 2 other farmers. We ask you to decide between the alternatives for each decision pair by ticking the box close to the preferred alternative. **Your decision, if you are selected, will determine the product and the potential payoff received by the 3 group members (you included).** The 2 other people will not take part in the decision but just share potential payoff and receive the product. You will not know the identity of your group members and vice versa.

You will have to take the following decisions regarding the budget of the group. We will then select at random **1 every 3 of you**, if you are selected your choice will be implemented determining the payoff and the product received by the 3 members of the group. **Of the 10 decision pairs, only 1 will be implemented** according to your decision.
If you are not selected (2 every 3 of you are not selected), none of your choices will be applied and your gain in this first part will depend on the decision of the selected member of your group.

Recap:

1. ***You take 10 decisions about the product and the payoff, for you and other 2 people. Those 2 individuals do not take the decision with you but share with you any payoff.***
2. *1 every 3 of you is selected.*
3. *1 every 10 decision pairs is drawn.*
4. *The preferred alternative of the person selected in the decision pair drawn determines the product and gains the 3 group members receive.*

You have to decide between receiving **two types of working gloves** for your farms at different conditions. The two gloves fulfil the same function and the two types are:

A "ECOLOGICAL WORKING GLOVES":

Bamboo working gloves, made of sustainable bamboo.

Bamboo is one of the fastest growing plants in the world.

Bamboo is a natural product that grows without any pesticides or fertilizers.

Bamboo is completely biodegradable, using it in the productive process instead of synthetic fibers it helps reducing waste.

Produced in sweatfree plants.

Excellent abrasion resistance.

B "NON ECOLOGICAL WORKING GLOVES":

Nylon working gloves, made in nylon knit.

Nylon is one of the most used man-made synthetic fiber.

Nylon is made from petrochemicals introduced as an early substitute for silk.

Excellent abrasion resistance.

This is an example of the decisions you will face

DECISION PAIR 1	A: Buy the ECOLOGICAL gloves and each of you three gets 0 euro	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and each of you three gets 3 euro	☐
DECISION PAIR 2	A: Buy the ECOLOGICAL gloves and each of you three gets 0 euro	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and each of you three gets 18 euro	☐

The 10 decision pairs are listed on the next page. The alternative A does not vary while the gain in alternative B varies for each decision pair.

Please tick the box next to the choice you prefer for **each of the 10 decision pairs**. In total, you will have to cross 10 boxes.

If you are selected, your choice for the decision pair drawn will be implemented and will determine the gains of your group.

*If **for example** decision pair 2 is selected and you marked alternative A, we will buy the ECOLOGICAL GLOVES for you 3 and you 3 will receive no payment. If you selected alternative B, we will buy the NON ECOLOGICAL GLOVES for you 3 and the experimenter in the next room will put 18 euro in the envelope each of you 3 will receive when leaving the experiment.* The gloves you choose will be sent to you and your group mates by courier at the address you gave us in the consent.

Comprehension questions

Select the box corresponding to the correct answer. Please raise your hand if you have any doubt about the correct answer.

How many people will take the decision about the product and your gain with you, if you are selected, in this first part (you included)?

0	2	6

How many people will share potential payoff with you, in this first part?

0	6	2

How many people will we draw in this first part?

Everybody	1 every 3 of you	2 every 3 of you

How many decisions do you have to take (total number of boxes that you will have to cross) ?

20	10	1

How many decision pairs will we then draw and implement, for the people selected?

2	1	10

SELECT THE BOX CORRESPONDING TO THE PURCHASE DECISION YOU PREFER FOR EACH DECISION PAIR (ONLY ONE BOX PER DECISION PAIR)

DECISION PAIR 1	A: Choose the ECOLOGICAL gloves and each of you three gets **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **2 euro** ☐
DECISION PAIR 2	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **4 euro** ☐
DECISION PAIR 3	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **6 euro** ☐
DECISION PAIR 4	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **8 euro** ☐
DECISION PAIR 5	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **10 euro** ☐

DECISION PAIR 6	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **12 euro** ☐
DECISION PAIR 7	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **14 euro** ☐
DECISION PAIR 8	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **16 euro** ☐
DECISION PAIR 9	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **18 euro** ☐
DECISION PAIR 10	A: Choose the ECOLOGICAL gloves and each of you three gets **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **20 euro** ☐

1.5.10 'C - I' Treatment - Collective decision, individual payoff

Beginning of the Study - Part One

With 2 other participants in this room (another 1 if we do not have enough participants), you have to decide about receiving a **product for your farm.**
You will decide in a group with 2 other producers participating to the study. Each of you will decide individually, the final decision will then be the one **preferred by the majority and will only affect the product you receive and your payment, not theirs**. The groups are randomly formed and the identity of the other 2 participants will never be revealed to you (and vice versa).

Your group has 10 decisions to take. We ask you to decide between the alternatives for each decision pair by ticking the box close to the preferred alternative. You do not decide alone: the final decision about your personal payoff and product will be the one preferred by the majority (2 out of 3 group members).
You will have to take the choices that follow about **your payment and the product to receive**. We will then select at random **1 in 3 people, if you are selected the result of the majority voting will determine your payment and product**. **Of the 10 decision pairs, only 1 will be implemented** according to the decision of the majority. If you are not selected (2 in 3 people are not selected), none of your choices will be implemented and you will receive no payment in this first part. Later in the study we will ask you to take the same decisions with respect to the product and the payment of another member of your group, in case you are not the one selected. Only the payoff of the group member selected will be determined by the majority.

Recap:

1. ***You take 10 decisions about your personal payoff and product.***
2. *1 every 3 of you is selected.*
3. *1 every 10 decision pairs is drawn.*
4. *The preferred alternative in the decision pair drawn determines the product and the gains the selected person receives.*

Your group has to decide between receiving **two types of working gloves** for your farm at different conditions. You will receive a pair of the gloves your group selected. The two gloves fulfil the same function and the two types are:

A "ECOLOGICAL WORKING GLOVES":

Bamboo working gloves, made of sustainable bamboo.

Bamboo is one of the fastest growing plants in the world.

Bamboo is a natural product that grows without any pesticides or fertilizers.

Bamboo is completely biodegradable, using it in the productive process instead of synthetic fibers it helps reducing waste.

Produced in sweatfree plants.

Excellent abrasion resistance.

B "NON ECOLOGICAL WORKING GLOVES":

Nylon working gloves, made in nylon knit.

Nylon is one of the most used man-made synthetic fiber.

Nylon is made from petrochemicals introduced as an early substitute for silk.

Excellent abrasion resistance.

This is an example of the decisions you will face

DECISION PAIR 1	A: Buy the ECOLOGICAL gloves and **you get 0 euro**	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and **you get 3 euro**	☐
DECISION PAIR 2	A: Buy the ECOLOGICAL gloves and **you get 0 euro**	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and **you get 18 euro**	☐

The 10 decision pairs are listed on the next page. The alternative A does not vary while the gain in alternative B varies for each decision pair.

Please tick the box next to your preferred alternative for **each of the 10 decision pairs**. In total, you will have to cross 10 boxes.
If you are selected, the alternative preferred by the majority for the decision pair drawn will be implemented and will determine your gains.
*If **for example** decision pair 2 is selected and at least 2 out of 3 of you marked alternative A, we will buy a pair of ECOLOGICAL GLOVES for your farm and you will receive no payment. If the majority selected alternative B, we will buy a pair of the NON ECOLOGICAL GLOVES and the experimenter in the next room will put 18 euro in the envelope you will receive when leaving the experiment.*
The gloves your group choose will be sent to your farm by courier at the address you gave us in the consent.

Comprehension questions

Select the box corresponding to the correct answer. Please raise your hand if you have any doubt about the correct answer.

How many people decide about the product and your gain, if you are selected, in this first part (you included)?

1	3	6

How many people will we draw in this first part?

Everybody	1 every 3 of you	2 every 3 of you

How many people will you share potential payoff with?

1	6	3

How many decisions do you have to take (total number of boxes that you will have to cross) ?

20	10	1

How many decision pairs will we then draw and implement, for the people selected?

2	1	10

SELECT THE BOX CORRESPONDING TO THE PURCHASE DECISION YOU PREFER FOR EACH DECISION PAIR (ONLY ONE BOX PER DECISION PAIR)

DECISION PAIR 1	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **2 euro** ☐
DECISION PAIR 2	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **4 euro** ☐
DECISION PAIR 3	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **6 euro** ☐
DECISION PAIR 4	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **8 euro** ☐
DECISION PAIR 5	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **10 euro** ☐

DECISION PAIR 6	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **12 euro** ☐
DECISION PAIR 7	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **14 euro** ☐
DECISION PAIR 8	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **16 euro** ☐
DECISION PAIR 9	A: Choose the ECOLOGICAL gloves and you get 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **18 euro** ☐
DECISION PAIR 10	A: Choose the ECOLOGICAL gloves and you get **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and you get **20 euro** ☐

If you are not selected, your previous decisions to allocate your budget will not be executed and your payment in this first part is zero.

We now ask each of you to take a similar decision another one of your group members. The following choices will affect the member of the group drawn (if you are not drawn). Also these choices will be taken by majority, by you and the other 2 group members.

We remind you that the following decisions are about the budget of the other 2 group members and will be executed if you are not drawn.

SELECT THE BOX CORRESPONDING TO THE PURCHASE DECISION YOU PREFER FOR EACH DECISION PAIR (ONLY ONE BOX PER DECISION PAIR)

DECISION PAIR 1	A: Choose the ECOLOGICAL gloves and your group mate gets **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **2 euro** ☐
DECISION PAIR 2	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **4 euro** ☐
DECISION PAIR 3	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **6 euro** ☐
DECISION PAIR 4	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **8 euro** ☐
DECISION PAIR 5	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **10 euro** ☐

DECISION PAIR 6	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **12 euro** ☐
DECISION PAIR 7	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **14 euro** ☐
DECISION PAIR 8	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **16 euro** ☐
DECISION PAIR 9	A: Choose the ECOLOGICAL gloves and your group mate gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **18 euro** ☐
DECISION PAIR 10	A: Choose the ECOLOGICAL gloves and your group mate gets **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and your group mate gets **20 euro** ☐

1.5.11 'C - C' Treatment - Collective payoff and decision

Beginning of the Study - Part One

With 2 other participants in this room (1 if we do not have enough participants) you have to decide about receiving a **product for your farms.** Each of you will decide individually, the final decision will then be the one **preferred by the majority** (2 out of 3 group members) **and will determine your payment and the product you will receive.** The groups are randomly formed and the identity of the other 2 participants will never be revealed to you (and vice versa).

Your group has to take 10 decisions. We ask each of you to decide between the alternatives for each decision pair by ticking the box close to the preferred alternative. The final decision will be the one preferred by the majority (2 out of 3 group members).
We will then select with a draw **1 every 3 groups**, the product and the payment of the 3 group members selected will depend on the choice of the majority. **Of the 10 decision pairs, only 1 will be implemented** according to the decision of the majority. The outcome preferred by the majority (alternative preferred by at least 2 out of 3 of you) for this selected decision will be implemented determining the payoff and the product received by the group.
If your group is not selected (2 every 3 groups are not selected), none of your choices will be applied and you will not gain anything in this first part.

Recap:

1. ***In a group with 2 other participants, you take 10 decisions about the product and the payoff by majority voting.***
2. *Each group has 1/3 chance to be selected.*
3. *1 every 10 decision pairs is drawn.*
4. *The alternative preferred by the majority in the decision pair drawn determines the products and the gains of the 3 group members.*

Your group has to decide between receiving **two types of working gloves** for your farms at different conditions. The two gloves fulfil the same function and the two types are:

A "ECOLOGICAL WORKING GLOVES":

Bamboo working gloves, made of sustainable bamboo.

Bamboo is one of the fastest growing plants in the world.

Bamboo is a natural product that grows without any pesticides or fertilizers.

Bamboo is completely biodegradable, using it in the productive process instead of synthetic fibers it helps reducing waste.

Produced in sweatfree plants.

Excellent abrasion resistance.

B "NON ECOLOGICAL WORKING GLOVES":

Nylon working gloves, made in nylon knit.

Nylon is one of the most used man-made synthetic fiber.

Nylon is made from petrochemicals introduced as an early substitute for silk.

Excellent abrasion resistance.

This is an example of the decisions you will face

DECISION PAIR 1	A: Buy the ECOLOGICAL gloves and each of you three gets 0 euro	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and each of you three gets 3 euro	☐
DECISION PAIR 2	A: Buy the ECOLOGICAL gloves and each of you three gets 0 euro	☐
	Or	
	B: Buy the NON ECOLOGICAL gloves and each of you three gets 18 euro	☐

The 10 decision pairs are listed on the next page. The alternative A does not vary while the gain in alternative B varies for each decision pair.

Please tick the box next to the choice you prefer for **each of the 10 decision pairs**. In total, you will have to cross 10 boxes.

If your group is selected, your choice for the decision pair drawn will be implemented and will determine the gains of your group.

*If **for example** decision pair 2 is selected and and at least 2 out of 3 of you marked alternative A, we will buy the ECOLOGICAL GLOVES for you 3 and you 3 will receive no payment. If the majority selected alternative B, we will buy the NON ECOLOGICAL GLOVES and the experimenter in the next room will put 18 euro in the envelope each of you 3 will receive when leaving the experiment.*

The gloves your group chose will be sent to your farm and to your group mates by courier at the address you gave us in the consent.

Comprehension questions

Select the box corresponding to the correct answer. Please raise your hand if you have any doubt about the correct answer.

How many people will take the decision about the product and your gain with you, if you are selected, in this first part (you included)?

0	2	6

How many people will share potential payoff with you, in this first part?

0	6	2

How many people will we draw in this first part?

Everybody	1 every 3 of you	2 every 3 of you

How many decisions do you have to take (total number of boxes that you will have to cross) ?

20	10	1

How many decision pairs will we then draw and implement, for the people selected?

2	1	10

SELECT THE BOX CORRESPONDING TO THE PURCHASE DECISION YOU PREFER FOR EACH DECISION PAIR (ONLY ONE BOX PER DECISION PAIR)

DECISION PAIR 1	A: Choose the ECOLOGICAL gloves and each of you three gets **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **2 euro** ☐
DECISION PAIR 2	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **4 euro** ☐
DECISION PAIR 3	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **6 euro** ☐
DECISION PAIR 4	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **8 euro** ☐
DECISION PAIR 5	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **10 euro** ☐

DECISION PAIR 6	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **12 euro** ☐
DECISION PAIR 7	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **14 euro** ☐
DECISION PAIR 8	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **16 euro** ☐
DECISION PAIR 9	A: Choose the ECOLOGICAL gloves and each of you three gets 0 euro ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **18 euro** ☐
DECISION PAIR 10	A: Choose the ECOLOGICAL gloves and each of you three gets **0 euro** ☐ Or B: Choose the NON ECOLOGICAL gloves and each of you three gets **20 euro** ☐

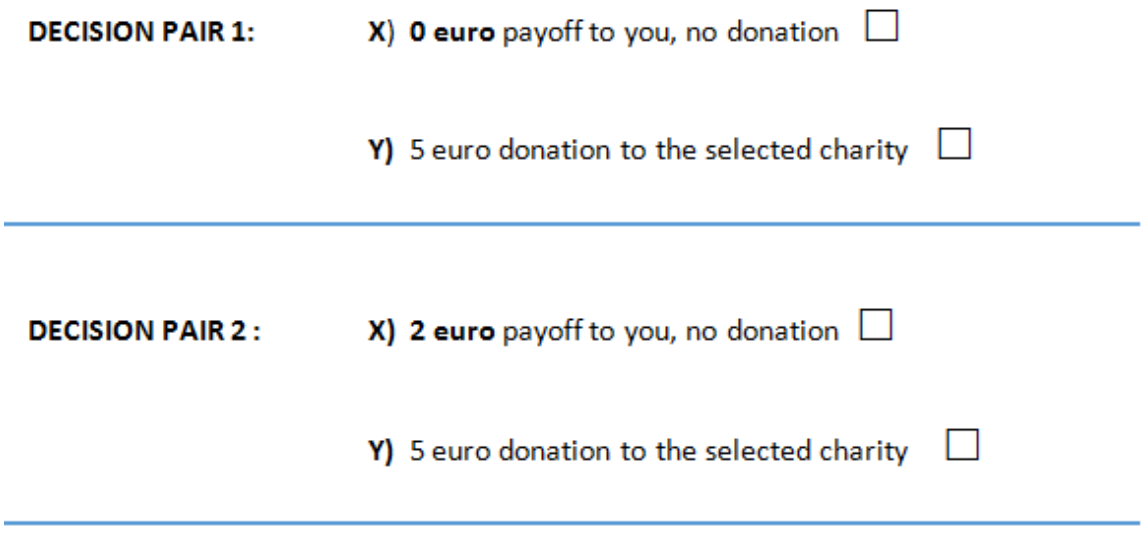
1.5.12 Part Two - Common to all Treatments

In this part, we ask you to decide in a choice list setting between two different allocations X and Y. On the following page, you will see 15 decision pairs like the one below. Each decision pair consists of the following two alternatives:

- Alternative X consists of an amount of money that varies and that will be paid to you.

- Alternative Y is a money donation of 5 Euro to ASeS.

ASeS (Agricoltori Solidarietà e Sviluppo, farmers solidarity and development) is a non-governmental organization (NGO) whose mission is to support rural communities in developing countries. Its projects aim at developing the agricultural capacities of those communities, at making the benefits of new technologies available and at improving the socio-sanitary aspects of the villages. Among the recent projects are the renovation of the water and sanitary system after severe droughts in several districts of Africa, the fight against drug addiction and abuse in Lebanon and the creation of a fair-trade laboratory for chocolate production.
An example of the decisions you will face:



For each decision pair you will have to decide on your preferred allocation. We will then select at random 1 in 15 decision pairs. This pair is then relevant for payment, for those of you not selected in the product decision. If you chose alternative X, you will receive the respective amount of

money. The experimenter in the next room will add the amount in the folder you will receive when leaving the experiment. If you chose alternative Y, we will send a 5 euro donation to ASeS. The confirmation of the total amount donated to the two charieties during this session will be sent by email to the address you gave us in the consent form. This is to allow you to verify the correctness of the statements made here.

SELECT THE BOX CORRESPONDING TO YOUR PREFERRED ALTERNATIVE FOR EACH DECISION PAIR (15 crosses)

DECISION PAIR 1:	**X**) **0 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 2 :	**X) 2 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 3 :	**X) 4 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 4 :	**X) 6 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 5 :	**X) 8 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 6 :	**X) 10 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 7 :	**X) 12 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐

DECISION PAIR 8 :	**X) 14 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 9 :	**X) 16 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 10 :	**X) 18 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 11 :	**X) 20 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 12 :	**X) 22 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 13 :	**X) 24 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 14:	**X) 26 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐
DECISION PAIR 15 :	**X) 28 euro** payoff to you, no donation	☐
	Y) 5 euro donation	☐

1.5.13 Questionnaire - Common to all Treatments

What is your gender?

M	F

What is your age

How many years have you been in business for?

How many employees do you have on average in your farm (people you pay wage to)?

How many people make decisions in your farm with you?

Which profit bracket does your farm belongs to?

¡30.000	30-50.000	50-70.000	70-100.000	100-250.000	250-400.000	¿400.000

Is your product ecological-bio-0 km (please specify)?

Do you usually buy cal goods at your farm (please specify)?

Do you think other farmers value the ecological quality of the product (cross the alternative you

consider correct):

More than you	Like you	Less than you

On a scale from 1 (not at all) to 7 (very much) how much did each of these reason influence your decision about the gloves:

1. The chance of receiving a payment

1	2	3	4	5	6	7

2. The ecological quality of the product

1	2	3	4	5	6	7

3. The SR quality of the product (sweatfree production)

1	2	3	4	5	6	7

4. The actual quality of the product

1	2	3	4	5	6	7

On a scale from 1 (not socially responsible) to 7 (very socially responsible)

1. How socially responsible do you see people who have bought the NON ECOLOGICAL GLOVES in this experiment?

1	2	3	4	5	6	7

2. How socially responsible do you see people who have NOT donated in this experiment?

1	2	3	4	5	6	7

On a scale from 1 (strongly disagree) to 7 (strongly agree), how much do you agree with each of the following statements:

1. It is important to me that the products I use do not harm the environment.

1	2	3	4	5	6	7

2. I consider the potential environmental impact of my actions when making many of my decisions.

1	2	3	4	5	6	7

3. My purchase habits are affected by my concern for our environment.

1	2	3	4	5	6	7

4. I am concerned about wasting the resources of our planet.

1	2	3	4	5	6	7

5. I would describe myself as environmentally responsible.

1	2	3	4	5	6	7

6. I am willing to be inconvenienced in order to take actions that are more environmentally friendly.

1	2	3	4	5	6	7

On a scale from 1 (no influence) to 7 (big influence)

1. How much would your decision be influenced by having to make a decision with a budget allocated to yourself only or a budget allocated to a group of people?

1	2	3	4	5	6	7

2. How much would your decision be influenced by having to decide on your own or in a group by majority?

1	2	3	4	5	6	7

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Chapter 2. Rewarding children with a food increases its liking

Parents often use sweet and calorie dense foods to reward their children. We hypothesize that such practices may contribute to the formation of unhealthy food preferences. To test this hypothesis, we conducted a randomized field experiment with 214 children in 3 schools in Germany. In the treatment classes, children were asked to complete a cognitive task in 6 visits over 3 weeks, and received dried apples as a reward. In the control group classes, children received the dried apple unconditionally. Receiving the food for solving the tasks might induce a positive association of the food with the positive feeling of being rewarded. It could also be that having to provide effort to obtain a food enhances the value of that food. We split the treatment groups into two, varying the length of the effort task between the two treatment groups. This allows us to identify whether the change in liking of the food reward is driven by the effort required. Our results show that rewarding children with food does increase their liking for the food reward. Also, increasing the effort required to obtain the reward does not impact the liking. These findings suggest that parents and carers should avoid using unhealthy food as rewards and may even use this mechanism to increase the liking of healthy food by using such foods as rewards.

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2.1 Introduction

Adverse health outcomes due to poor nutrition are a major concern [49]. In 2010 in EU, the prevalence of overweight and obesity in children aged 6 to 9 years ranged from 18% to 57% amongst boys and from 18% to 50% amongst girls [50].These early signs of obesity are especially worrying, as overweight in early life often persists into adulthood [36, 15, 39]. Children's food choices are mainly determined by their preferences [20], for example the liking for vegetables appears the most significant predictor of their intake [12]. This makes it essential to understand how preferences are formed. Also, preferences were found to be malleable among young children before becoming more rigid with age [19] and a few recent studies provide encouraging evidence that early interventions may be promising to alter the formation of dietary habits and reduce obesity [37].

With a field experiment in three primary schools in Cologne, Germany, we provide novel casual evidence that rewarding the completion of a cognitive task with a food for a repeated number of times enhances the liking for that food. Following the social science literature, the practice of using food as a reward may reinforce its liking for two possible reasons. First, the psychological theory of evaluative conditioning proposes the positive association of the food with the positive feeling of achievement might increase its liking [17]. Alternatively, the liking and valuation of an object can increase with the effort required to obtain this object [34]. To shed more light on the role of effort, we introduce two treatments: one where the task requires little effort and one where it requires a lot more effort. Children in the control group, were simply offered food to control for the exposure effect.[1]

[1] According to the exposure effect, repeated tasting of a particular flavour increase its liking and acceptance consumption [9, 10].

To detect a change in liking for the food reward, we elicit it before, after the study and in a 4 weeks follow-up. We elicit 3 different measures of liking for 4 food items tasted during the session (including the food reward): an incentivised *choice* of a food to receive as a snack; the self-reported *valuation* of the foods on a 4-point scale ranging from 1 a very sad to 4 a very happy face, measured with smileys; and count of favourable direct *comparisons* between the food reward and three alternative snacks. We find evidence that using food as a reward increases the liking of this foods. The observed treatment effect seems most in line with positive association and evaluative conditioning, where individuals attach an increased value to a food that they previously received in the positive context of being rewarded. Effort seems to not play a role in mediating the liking in this context, as additional effort to receive the food reward does not induce a higher nor a lower liking of the food reward.

In our culture sweets are frequently presented in a positive social-affective context: they are present at parties, at holiday celebrations such as Christmas and Easter, they are used as reward and reinforcer of good behaviours. About forty percent of the respondents to a survey among European parents state that they use food as a reward for their children [31]. A link between the use of food rewarding practices by parents and higher consumption of sweets by their children has already been shown by a correlational study[44]. Even though another recent study did not find a direct effect of food reward use on snack food consumption in the absence of hunger [18]. Children from households with a high use of food reward or food restriction practices ate significantly more snacks after experiments induced negative mood, compared to a neutral condition[18].

We study the role of using food as a reward for desirable behaviour in enhanching the liking of that food. To the best of the authors' knowledge, these results extend

the existing literature by providing the first causal estimates based on experiential data gathered in a real-life setting.

We hypothesize that rewarding a desired behaviour with a specific food enhances liking for that food for two possible reasons. Firstly, previous research suggests that individual preference and liking can be altered by pairing a conditional stimulus with other positive or negative (unconditional) stimuli [41]. Associating an item with a positive experience, even without cognitive awareness, can increase individuals' preference for it [17, 23]. Some sparse evidence suggests that conditioning can alter food preferences among children. For instance, forcing children to eat foods against their will pairs the food item with negative affect and increases long-term rejection [4]. Positive conditioning with other palatable foods, high caloric content and positive social context can also influence preference [3, 24, 25]. Associating a food with the positive feeling of accomplishment could hence enhance its liking.

Secondly, there is substantial evidence from studies in behavioural economics for an "endowment effect", where one's liking of an object is higher if one had to work harder to obtain it[34]. In psychology, this has been referred to as "effort justification". According to this phenomenon, people who have exerted some effort in obtaining an object try to reduce the cognitive dissonance between the effort exerted and the perceived value of the object by increasing their liking of it.[2] This effect has been documented already in children as young as 6 years old [7], however outside the food domain. Hence, receiving a food as a reward to one's performance should

[2]Akerlof and Dickens [1] translate the psychological theory of cognitive dissonance into an economic model. In their model people not only have preferences over different states of the world, but also over their beliefs about those states. As supported by many psychological experiments [11, 29], crucially people can manipulate their beliefs. According to their model, if the psychological benefit of changing the evaluation of the object-reward exceeds the cost due to discomfort of having invested effort to obtain a non valuable-enough reward, the subject will believe the object was worth the effort.

therefore increase its liking. The higher the effort required to obtain the reward, the higher the increase in liking.

Our paper relates to several policy interventions to improve eating habits inspired by insights from behavioural economics, in particular a series of interventions targeted at children and schools (see for example Just and Price [27], Team [42] and Thaler and Sunstein [43]). Interventions at kindergartens and elementary schools have explored the effect of short messages prompting for fruit and vegetables selection, giving original names to healthy foods, modifying food presentation and default options have proven to be successful in improving the selection of healthy items (see among others Hanks et al. [21], Wansink et al. [46, 45], Smith et al. [40], Just and Price [26], respectively).[3] Another widely explored tool is the use of rewards as stickers or toys, to encourage choice and consumption of fruit and vegetables in schools at lunch. A series of studies has found positive effects on the short term consumption and mixed results on long lasting effects of incentivising healthier eating [6, 33, 35]. This use of this tool is though debatable, because of the possibility of crowding out the intrinsic motivation in eating those foods [8, 32].

The remainder of this chapter proceeds as follows. Section 2.2 outlines the experimental environment. We present (1) the recruitment procedure, (2) the outcome variables, (3) the treatments, (4) the descriptive statistics of the sample, (5) the analysis of the correation amongst different outcome variables and the transitivity of preference and (6) finally the hypotheses. Section 2.3 discusses the results, presenting the non parametric analysis first and then the regression analysis. Section 2.4 concludes.

[3]See Kessler [28] for a review of studies aimed at improving the quality of school nutrition in the United States.

2.2 Experimental Environment

2.2.1 Recruitment Procedure

To examine the effect of the use of food as a reward we conducted a clustered randomized field experiment with 214 school children aged 6 to 8 conducted in Cologne, Germany.[4]

We contacted all the schools in Cologne with at least three first graders classes, inviting them to participate to the experiment. We explained the study aimed at understanding the drivers of dietary choices to design tools to encourage healthier eating habits, without giving any specific information. Neither the head of the schools nor the teachers were informed about the research question until the end of the experiment. An English version of the letter for the schools is in Appendix 2.4.1, figure 2.4.1. Three schools responded positively to our interest and were included in the study. Two of the schools had 3 first grade classes and the third one had 5 classes participating to the study. The interactions between classes in the same school was limited during the time of the experiment, hence we do not expect a strong spillover effect between treatments. 11 classes took part in total. In 3 schools we randomly assigned classes to 3 treatment groups, including one control, within each school. Parents were informed about the study prior its beginning with a letter (see Appendix 2.4.1, figure 2.4.2), they were asked about children's dietary restrictions and they could opt out their child at any point in time. Children were also informed that participation was voluntary and that they could drop out the study at any time. On the first day of the study, we also distributed a survey to children to take home for the parents (see Appendix 2.4.1, figure 2.4.3).

[4]Ethical approval to conduct the study was obtained from the Ethics Sub-Committee of the School of Economics of The University of Edinburgh.

2.2.2 Outcome Variables

The study took place in Cologne in the period between April and July 2016 and consisted in 9 visits per class. During the first 4 weeks, we visited the school twice per week, with a follow-up visit after one month. The study protocol included 3 assessment sessions (visit 1, 8 & 9) and 6 treatment sessions (visits 2 to 7). During the

Week 1	1^{st} Assessment session
	1^{st} Treatment session
Week 2	2^{nd} Treatment session
	3^{rd} Treatment session
Week 3	4^{th} Treatment session
	5^{th} Treatment session
Week 4	6^{th} Treatment session
	2^{nd} Assessment session
Week 8	3^{rd} Assessment session

assessment sessions, we measured children's liking for a piece of dried apple, the food reward, with three alternative measures described here below: valuation, comparison and choice. First, children sampled the dried apple and 3 other snacks (a dried apricot, a cracker and a natural yogurt). Then ranked their valuation on a 4-point scale ranging from a sad to a happy smiley (*valuation*). Second, children were asked to conduct 5 comparisons of preference between two of the snacks, including two additional hypothetical comparisons to French fries and gummy bears (*comparison*). Third, children were asked to choose their overall preferred snack. This choice was incentivised as children received their chosen snack at the end of the assessment session (*choice*). We additionally ask children to indicate their preference between

dried apples and 2 food items that are typically popular among children but are calorie dense (gummy bears and French fries), to test whether using food as a reward can divert this hypothetical choice from a more palatable-calorie dense item to a different one. The questionnaires used to determine the self-reported valuation, the incentivised choice and the hypothetical choices between pairs of food items are in Appendix 2.4.2, figure 2.4.6, 2.4.7, 2.4.8 and 2.4.9. We chose the 4 snacks based on pilot sessions in 2 classes (not involved in the experiment), among 10 snacks. Details are in Appendix 2.4.3.

2.2.3 Treatments

The classes in the control group (CO) and treatment groups were visited at the same frequency. In the treatment groups, we ensured a balanced exposure to the reward item by providing assistance to children who had difficulties with the effort task. As a consequence, all children received a reward from the experimenter, saying: "Well done, here is your reward!". In the control group classes, children received an unconditional offering of the food reward ("Here, have a piece of apple"). All children in this group eat the food the same number of times to control for the *exposure effect*, where repeated tasting of a particular flavour increase its liking and acceptance consumption [9, 47, 10]. Each control session lasted around 5 minutes. In the treatment classes, children were asked at each visit to complete a cognitive task, and received the dried apple as a reward for completing the task. The task consisted of counting a number of random dots in several different pictures. The number of pictures varied between the two treatment groups: in the effortless group (EL) children had to count dots in 2 pictures, while in the effortful group (EF) they were required to count dots in 10 pictures. Varying the number of pictures allows to identify the role of effort in driving a change in liking of the dried apple. In the effortless group the time needed

to solve the 2 mandatory puzzles was 2 to 6 minutes, while in the effortful group was between 4 and 10 minutes.

The positive association of the food with the feeling of achievement is expected to be similar between the groups, leading to a higher liking of the food reward in both treatment groups. Since children in the effortful group had to exert more effort by solving more tasks compared to those in the effortless group, such higher effort could further enhance the liking of the food reward through the endowment effect. It is also possible that the higher effort decreases the liking, through the negative costly experience of providing effort.

In Appendix 2.4.2, figure 2.4.4 is an example of the task. The number of dots in each picture is chosen randomly in a range 6-18. In both effort conditions children are instructed about the possibility of solving more than the mandatory puzzles (2 and 10 respectively) although the awarding of the prize depends solely on their correct completion of the mandatory ones. The number of puzzles solved among the optional ones could serve as a proxy for the level of intrinsic motivation in the task and to study whether it changes with repetitions. We also ask children how much did they like the task (Appendix 2.4.2 figure 2.4.5). The number of puzzles tried among the optional ones and the self-reported valuation for the task is very similar across the two effort groups and the 6 sessions. We consider the session ended when all the children finish counting the dots in the required pictures. Since we offered help to children in order for all of them to receive the reward, we registered the amount of help required by children. Help in the effortful group is significantly higher than in the effortless, controlling for help does not modify the results of the analysis.

2.2.4 Descriptive Statistics

The descriptive statistics in Table 2.2.1 show no differences between the groups in terms of child characteristics (age and sex) or liking of the food reward in all 3 measures at baseline, suggesting that despite an admittedly small number of classes the randomization resulted in balanced groups. Results from Table 2.2.1 also show that refusal of trying the reward and attendance do not vary between treatments and is unlikely confound our results. Neither exposure nor participation in the treatment groups differs from the control. To keep the sample consistent between all analytical steps, we only study children present during all 3 assessments. Such a complete case analysis yields unbiased estimates as long as observations are missing at random [5]. In support of this assumption, we fail to predict missing values based on group assignment or liking at baseline (see Appendix 2.4.5, Table 2.4.4). Also, an analysis of the full sample is available in the supplemental material (2.4.6, Table 2.4.5).

2.2.5 Correlation and Transitivity

We collect 3 different measures of children's food liking.

1. Choice: the incentivised choice of a snack among the 4 snack tasted in the assessment session.

2. Valuation: the self-reported valuation of the food from 1 to 4, with the selection of a smiley.

3. Comparison: the number of times the food reward is preferred in the pairwise comparison between two foods.

We report the correlation between these measures in Appendix 2.4.4. The estimates of the Pearson's correlation coefficient between the different outcome measures for

Table 2.2.1: Summary Statistics and Initial Levels

	(1) Control	(2) Effortless	(3) Effortful	(4) Total	(5) Min	(6) Max	(7) (1)vs.(2)[e]	(8) (1)vs.(3)[e]
Number of children:								
total	59	79	76	214				
allergic to apples	1	0	1	2				
incomplete data	10	11	14	35				
analyzed	48	68	61	177				
Number of classes	3	4	4	11				
Age (years)[a]	6.59	6.59	6.68	6.62	6	8	0.82	0.52
Female (%)[a]	46	41	48	44	0	1	0.66	0.84
Attendance[b]	5.79	5.62	5.57	5.65	0	6	0.10	0.22
Tried reward[c]	4.13	4.16	3.98	4.09	0	6	0.92	0.80
Choices[d]	0.08	0.06	0.03	0.06	0	1	0.61	0.25
Valuation[d]	2.31	2.57	2.26	2.40	1	4	0.31	0.96
Comparison [d]	0.93	0.79	0.90	0.87	0	5	0.54	0.77

[a] Values based on a parental survey response with varying sample size (N): Control(35); Effortless (48); Effortful(47).
[b] Average frequency of attendance to the 6 treatment sessions.
[c] Average frequency of trying the food reward to the 6 treatment sessions.

[d] Average value at baseline
[e] P-values based on a two-sample Wilcoxon rank-sum (Mann-Whitney) test for ordinal variables. A two-sample proportions test is used for binary variables.

each food show a positive correlation in all the assessments (the coefficients in the bordered boxes). The majority of coefficients identify a moderate or strong correlation, especially between the self-reported valuation and the preferences. The correlation between liking of different foods is generally negative.

In the pairwise comparison between two foods, there is the possibility that children show non-transitive preferences (where food A is preferred to food B, food B is preferred to food C but food C is preferred to food A). Harbaugh et al. [22] studies whether children's behaviour is rational and whether it is reasonable to draw inferences about their preferences from their choices. In an experiment 7, 11 and 21 years old subjects are asked to choose their favourite bundle of goods from a list of a few alternative possibilities. At age 7, children's choices about consumption already respect transitivity and show rationality, though some revealed preference violations are present at all ages. 26% of the participants makes choices that are consistent with utility maximization at 7, with the percentage raising to 60 for 11-year-old participants, similarly to 21-year-old participants.

In Appendix 2.4.4, we study the transitivity of preferences in the hypothetical choice between two of the snacks. In each assessment session each child can violate transitivity 24 times, but the maximum amount of intransitive choices per assessment is 7. 50% of children have transitive preferences (0 violations).

2.2.6 Hypotheses

A. We expect the liking for the food-reward to strengthen in all groups, due to the exposure effect.

B. If rewarding with a food generates a positive association with the feeling of accomplishment, children in the two effort treatments have a stronger improve-

ment in liking for the food-reward than the control group.

This implies children in the two treatment groups will choose dried apple more often as a snack, give dried apple a better liking and prefer them more often in the comparisons with other foods.

C. If the amount of effort exert to receive the reward increases its value (i.e. effort justification effect), children in the effortful treatment have a stronger improvement in liking for the food-reward than the effortless treatment.

Alternatively, the literature in economics assumes a cost of effort, with effort entering the utility function with a negative sign [30, 2].

C.a If effort is costly, in the effortful group the higher disutility from effort reduces the positive association of the food-reward with the feeling of achievement. Children in the effortful treatment have a decrease in liking for the food-reward than the effortless treatment.

2.3 Results

2.3.1 Non Parametric Analysis

First, we show and compare the distributions of all 3 outcome measures (see Figure 2.3.1). In the control group we find a higher liking of the food reward in later assessments, confirming the positive impact on liking of exposure. In our experimental set-up, we keep exposure to the dried apples constant for all groups and can therefore cleanly distinguish between exposure and treatment effects. Comparing children who received the dried apple unconditionally to those who received it as a reward, we observe significant treatment effects in all three measures of liking. Indeed, compared to the control group, children in the treatment groups have a higher

liking for the food-reward in all 3 measures during the second assessment. Panel (a) in Figure 2.3.1 presents the incentivised measure (percentage of children choosing the dried apple as a snack, among the 4 snacks tasted in the assessment), panel (b) presents the mean valuation of the dried apple measured with the selection of a smiley and panel (c) presents the mean number of times the apple was preferred to an alternative food in the pairwise comparison. For the effortless group, we observe an increased liking of the dried apple measured with all the 3 outcome measured. These differences are statistically significant for *valuation* [Mann-Whitney test (M-WT): z=2.39, P=0.02] and *comparison* [M-WT: z=1.93, P=0.05], but not for *choice* [Two-sample proportions test (TPT): z=1.24, P=0.22]. No significant difference can be observed between children in the control and effortful group [M-WT: *valuation*, z=1.15, P=0.28; TPT: *choice*, z=0.54, P=0.59; M-WT: *comparison*, z=1.19, P=0.24]. The respective effects sizes can be considered small to medium, with higher values for the effortless [*valuation*, d=0.36; *choice*, d=0.42; *comparison*, d=0.44] than the effortful group [*valuation*, d=0.20; *choice*, d=0.20; *comparison*, d=0.29].

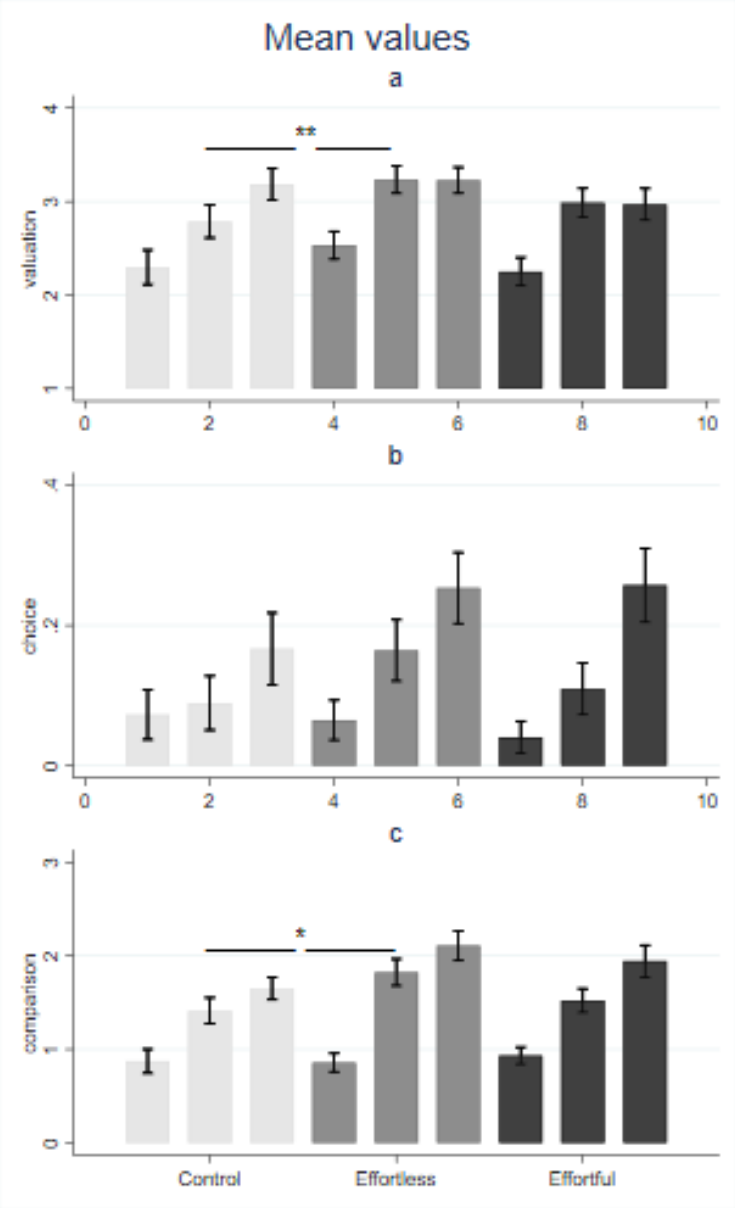

Figure 2.3.1: Mean results

Panels a-c show the means of the 3 outcome variables for dried apple at all 3 assessments for each group. Incentivised choice measured as percentage of children picking apples as their preferred snack. Valuation measured on 4-point ordinal scale from 1 (I hate the food) to 4 (I love the food). Comparison measured as number of times apples are preferred in direct comparison to the 3 other foods and 2 hypothetical snacks. Error bars reflect +/- 1SEM. Between group differences from the non-parametric significance tests indicated by * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We then analyse the effect of our intervention as the average difference in liking between assessments. Table 2.3.1 reports the average differences in liking across treatments. Figure 2.3.2 displays the short-term effect as the average difference in liking between the first and the second assessment for the control group and the treatment groups. We confirm a general increase in the liking which also effects the control group due to exposure [*choice*: McNemar-Test, P=1.00; *valuation*: Wilcoxon, P<0.01; *comparison*: Wilcoxon P<0.01]. Also, we confirm that children who had to work to receive the food displayed a significantly larger increase in liking as compared to those who received the apple unconditionally [*choice*: chi2=5.22, P=0.07; *valuation*: M-WT, z= 1.75, P=0.08; *comparison*: M-WT, z= 1.95, P=0.05].

Table 2.3.1: Average difference in liking between assessments

		CO	EL	EF	CO vs. EL+EF[c]	EL vs. EF[c]
Choice	Short-term [a]	0.000	0,103	0,082	0.074	0.348
	Long-term [b]	0.063	0.191	0.230	0.044	0.383
Valuation	Short-term	0.417	0.618	0,721	0.0794	0.894
	Long-term	0.833	0.706	0,705	0.3559	0.921
Comparison	Short-term	0.354	0.971	0,672	0.0516	0.161
	Long-term	0.708	1.294	1,115	0.0474	0.033

[a] Difference between the measure of liking in second assessment and baseline (short-term)

[b] Difference between the measure of liking in third assessment and baseline (long-term)

[c] P-values based on a two-sample Wilcoxon rank-sum (Mann-Whitney) test for ordinal variables. Fisher's exact test is used for binary variables.

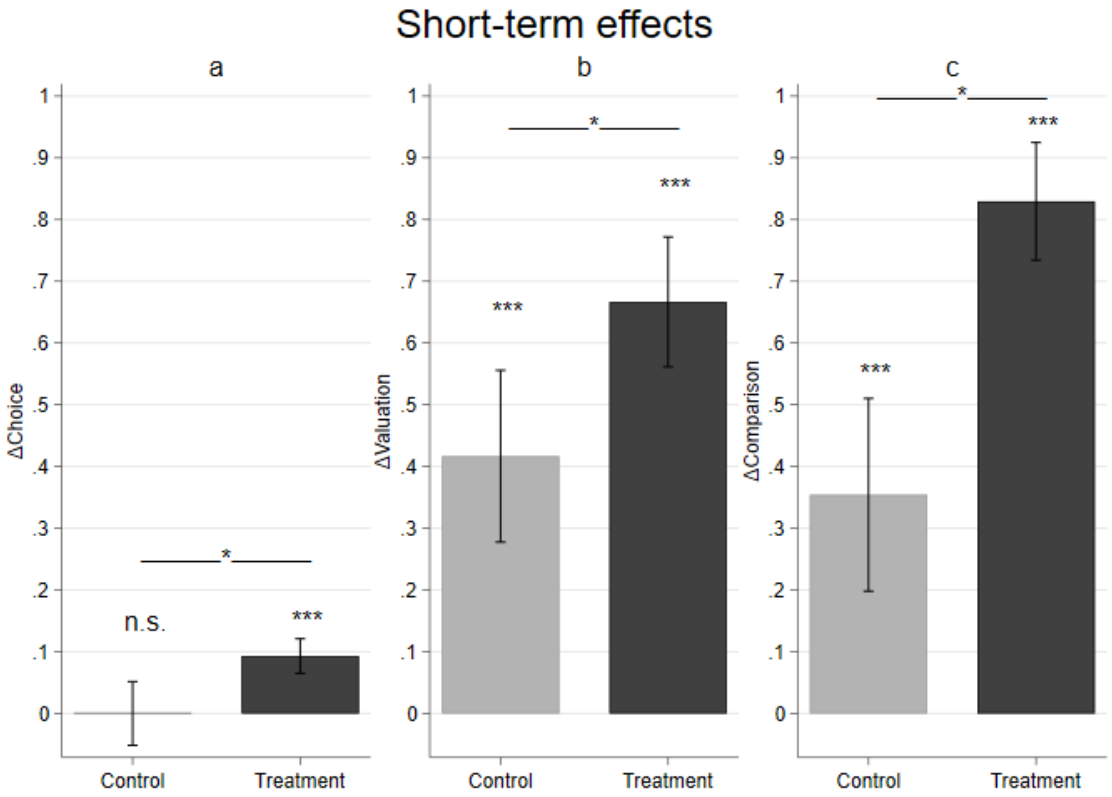

Figure 2.3.2: Short-term effects

Short-term effects displayed as the difference in the three measures of liking - **a.** *choice*: change in percentage, **b.** *valuation*: change on 4-point scale, and **c.** *comparison*: change in 5 comparisons - from the 1st and the 2nd assessment. Results of a comparison to the baseline are reported above the bars, we report results of a McNemar Test for *choice* and a Wilcoxon test for *valuation* and *comparison*. Results for a comparison between treated and control are indicated by brackets. We conduct a Chi2 test for *choice* and a U-test for *valuation* and *comparison*. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

To assess the long-term effect of our intervention, we returned to the schools 4 weeks after the second assessment. Figure 2.3.3 displays the average difference in liking between the first and the third assessment for both groups. Again, we find evidence for a significant exposure effect in our control group [*choice*: McNemar-Test, P=0.31; *valuation*: Wilcoxon, P<0.01; *comparison*: Wilcoxon P<0.01]. Furthermore, we observe a significant treatment effect for *choice* [Chi2: p=0.04] and *comparison* [U-test: p=0.05], but no significant treatment effect for *valuation* [U-test: p=0.36]. The non significant treatment effect measure with this outcome is mainly driven by a larger increase in *valuation* for the control group in the long-term, but the *valuation* of dried apple is enhanced in the two treatment groups as well.

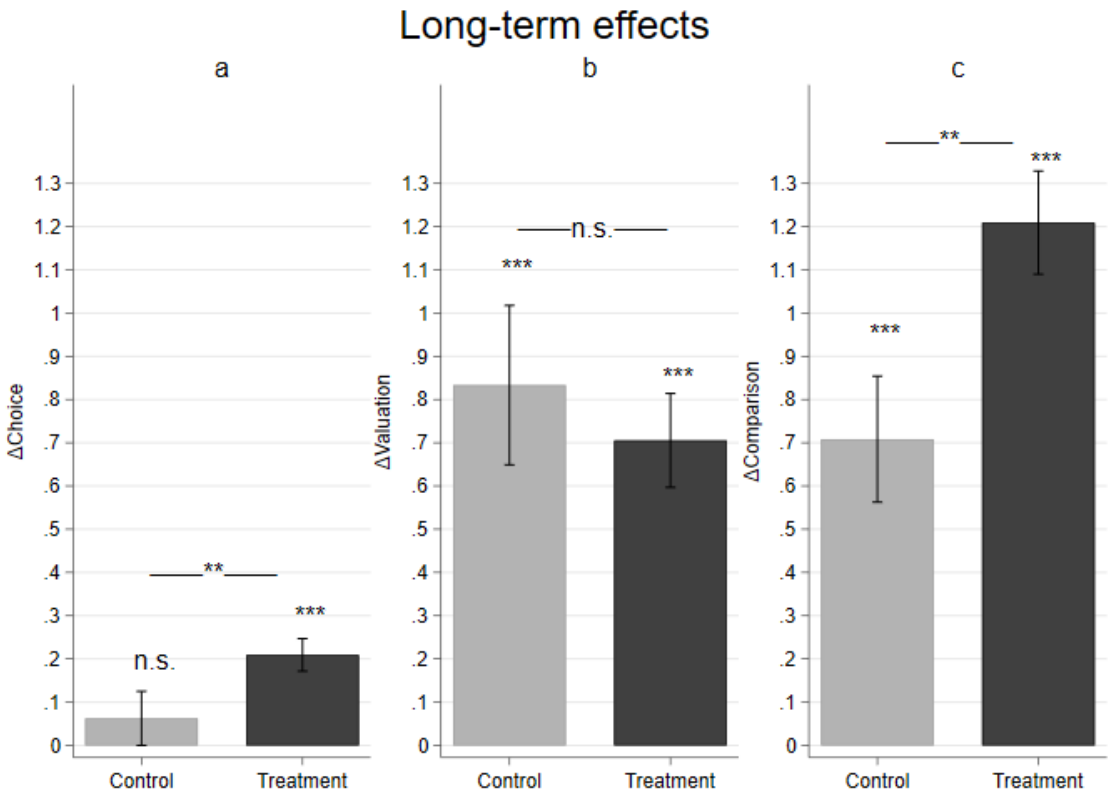

Figure 2.3.3: Long-term effects

Long-term effects displayed as the difference in the three measures of liking - **a.** *choice*: change in percentage, **b.** *valuation*: change on 4-point scale, and **c.** *comparison*: change in 5 comparisons - from the 1st and the 3rd assessment. Results of a comparison to the baseline are reported above the bars, we report results of a McNemar Test for *choice* and a Wilcoxon test for *valuation* and *comparison*. Results for a comparison between treated and control are indicated by brackets. We conduct a Chi2 test for *choice* and a U-test for *valuation* and *comparison*. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.3.2 Regression Analysis

We analyse the impact of the treatment, i.e. receiving the food as reward, and of effort on the liking for dried apples in the second and third assessments choices , by estimating linear models for the 3 outcomes described in the previous section (*choice*, *valuation* and *comparison*). We estimate models of the following form:

$$Y_i^{t+1} = \beta_0 + \beta_1 Treatment_i + \beta_2 Higheffort_i + Y_i^t + \gamma_i School_i + \epsilon_i$$

Where Y_i^{t+1} denotes an outcome measure for liking of dried apples in later assessments (second or third), $Treatment_i$ is the dummy variable for the randomly assigned experimental treatment of receiving the food as reward and $Higheffort_i$ is the dummy variable for assignment to the high-effort treatment. β_1 and β_2 are the coefficients of interest. As control variables we include the baseline level of liking of dried apples Y_i^t and a dummy for the school $School_i$. ϵ_i is an idiosyncratic error term. We estimate all models using the ordinary least squares (OLS) estimator, with estimate standard errors robust to clustering at the class level. Due to the relatively small number of clusters (11 classes), the wild cluster bootstrap approach proposed by Cameron et al. [13] need to be used used to estimate the clustered standard errors, which requires the estimation of a linear model. The results from different methods to address the clustered nature of our data can be found in Appendix 2.4.7, Table 2.4.6.

Columns 1 to 3 show the results for the short-term effects and support our findings from the non-parametric analysis. The treatment coefficient indicates the main effect of food rewards, which is significantly different from the control group in all three measures of liking. The long-term effects reported in columns 4 to 6 also support our prior findings and indicate persistent treatment effects in two of our three measures, i.e. in *choice* and in *comparison*. Effort justification theory predicts a stronger

treatment effect for children who have to provide high effort as compared to those who only have to provide low effort to receive the food reward. The coefficient for high effort is small and not significant except for comparison in the short-term analysis where it is actually significantly negative (contradicting the prediction of effort justification). Thus, we find no support that the observed effect of using food as a reward on food liking is driven by effort justification. Evaluative conditioning is a more plausible explanation for the observed treatment effect.

As mentioned above, treatment was assigned at the class level and we must account for the nested structure of the data. Considering each class as a cluster, we find the intra cluster correlation (ICC) within the classes to be generally low: for all outcome measures the ICC never reaches a value above 0.1 (baseline ICC: valuation=0.000; choice=0.02; comparison=0.09). In Appendix 2.4.7 Table 2.4.6, compared to the regular cluster method [48] [38], the use of wild bootstrap clusters slightly increases the standard errors and results into the loss of significance particularly for the effortful group. Appenidx 2.4.8 reports placebo regression for the other foods used in the assessment sessions.

2.4 Conclusion

Previous literature aimed at finding tools to improve children's dietary liking and consumption. The focus has mainly been on the use of incentives and rewards for the consumption of fruits and vegetables [6, 33, 35]. Other experimental studies have proven the positive impact of using behavioural interventions, as the use of healthy defaults options or creative presentation of foods [40, 45, 26]. In an experimental study among children, we find evidence that using a food as a reward and incentive increases the liking of this foods. The observed treatment effect seems most in line

Table 2.3.2: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
		(Short-term)			(Long-term)	
	Choice	Valuation	Comparison	Choice	Valuation	Comparison
Treatment	0.0883**	0.297*	0.567***	0.123**	-0.0624	0.543***
	(0.011)	(0.056)	(0.001)	(0.021)	(0.795)	(0.000)
High-effort	-0.0282	-0.0301	-0.250*	0.0285	-0.195	-0.139
	(0.455)	(0.838)	(0.065)	(0.658)	(0.281)	(0.375)
Baseline :	0.540***	0.609***	0.496***	0.403***	0.509***	0.526***
	(0.002)	(0.000)	(0.001)	(0.005)	(0.000)	(0.000)
School 1	ref.	ref.	ref.	ref.	ref.	ref.
School 2	-0.114**	0.150	0.338**	-0.00807	0.0694	0.438***
	(0.020)	(0.276)	(0.017)	(0.904)	(0.759)	(0.010)
School 3	-0.0809*	0.177	0.147	-0.0686	0.504*	0.222
	(0.081)	(0.110)	(0.193)	(0.405)	(0.053)	(0.200)
Constant	0.109***	1.206***	0.647***	0.137**	1.785***	0.910***
	(0.009)	(0.000)	(0.000)	(0.029)	(0.000)	(0.000)
N	177	177	177	177	177	177

Notes: p-values clustered on the class level in Columns (1), (2) and (3) refer to the second assessment columns (4), (5) and (6) to the follow-up. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

with evaluative conditioning, where individuals attach an increased value to a food that they previously received in the positive context of being rewarded. Exerting more effort to receive the reward was not associated with higher increase in liking. The evidence provided here bears a number of implications that ought to guide further research but should also be considered by parents and policy-makers alike. Parents might refrain from using sweet and energy dense foods to reward their children for desirable behaviour, introducing less liked and healthier foods as a reward or in positive situations.

Future health interventions may try to leverage this effect to increase liking for healthy foods by using them as rewards. Future research should explore whether this mechanism can be observed in a broader social context and affects liking for foods that are offered during special occasions such as Christmas. It should also explore the impact of introducing foods in negative situations to test whether this would induce a negative association of the food. More research should also analyse whether the use of a disliked food item as reward could improve its liking, as a tool to reduce picky eating. Also, it could be explored whether a different number of repetitions of the treatment (using food as a reward) would have a different impact on liking. Increasing the number the repetition might indeed induce boredom, cancelling the novelty and the positive impact of the feeling of achievement associated to the food reward.

Finally, the increased liking for dried apple could be partially driven by experimenter demand effect, which should though not affect crucially the comparison between treatment and control.

Appendix

2.4.1 Letters and Leaflets (communication with parents and schools)

This section presents the translated version from German of the letters and leaflets used in the experiment.

Universität zu Köln

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Wirtschafts- und Sozialwissenschaftliche Fakultät

Seminar für Allgemeine Betriebswirtschaftslehre und Personalwirtschaftslehre

Jun.-Prof. Dr. Marina Schröder
Telefon +49 221 470-6939
Telefax +49 221 470-5078
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http://www.pwl.uni-koeln.de

Project on children's dietary choices

Köln, 24.04.2017

In Kooperation mit:

Dear head of school,

We are a team of social scientists from the University of Cologne and the University of Edinburgh. We are contacting you because we would like your school to take part in our study about children's dietary choices. The study is part of a larger project funded by the European Union involving leading universities across Europe. The aim of the project is to understand the drivers of dietary choices in order to design tools to encourage healthier eating-habits. The project involves scientists from different disciplines such as neuroscience, psychology and economics. If you are interested in knowing a little more about the projects you can find some information online at the website:
http://www.nudge-it.eu/

This specific project focuses on food preferences of first graders. We would like to conduct a study in your school, ideally in April and May 2016. The study would consist of 8 visits to your first grade classes, lasting between 15 to 45 minutes each. During the visits we will ask children to complete different tasks (mazes and counting tasks) in class and we will ask children to taste various food items.

The project was reviewed and approved by an academic ethical review committee, following the guidelines of the European Commission. Upon your approval, we will distribute a leaflet to parents informing them about our intention to carry our study in your school. Parents will be given the option to opt out their child from the project and we will also solicit students' willingness to participate in

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50923 Köln

the study. All the information we collect will be stored safely and securely and in accordance to our data protection guidelines. Each child will be given an identifier (a number), that will allow us to keep all information anonymous. All data collected will only be used for research purposes. At the end of the study, we will share with you the results of our research to improve children's eating habits and a booklet summarizing the findings of the study.

We would be most grateful if you would agree to a personal meeting, in which we present our research plan to you and discuss a potential cooperation with your school. Please contact us by phone (0221-470-6939) or by email (marina.schroeder@uni-koeln.de) to schedule an appointment, which is of course without any obligation for your school.

Thank you a lot in advance
Yours Faithfully,

Prof. Dr. Michèle Belot
School of Economics
University of Edinburgh

Jun. Prof. Dr. Marina Schröder
School of Management,
Economics and Social Sciences
University of Cologne

Martina Vecchi
School of Economics
University of Edinburgh

Figure 2.4.1: Information for the Schools

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Köln, 24.04.2017

Wirtschafts- und Sozialwissenschaftliche Fakultät

Seminar für Allgemeine Betriebswirtschaftslehre und Personalwirtschaftslehre

Jun.-Prof. Dr. Marina Schröder
Telefon +49 221 470-6939
Telefax +49 221 470-5078
marina.schroeder@uni-koeln.de
http://www.pwl.uni-koeln.de

Dear Parent/children caretaker

We are a team of scientists from the University of Cologne and the University of Edinburgh. We would like to invite your child to take part in a research study on food preferences, that we intend to conduct at [NAME OF THE SCHOOL] on [DATES]. We would like to ask children to taste different foods and to indicate their liking of these foods. Furthermore, we would ask the children to solve simple tasks.

The study is part of a larger project funded by the European Union involving leading universities across Europe, which aims at understanding the drivers of food preferences at different ages. If you are interested in the details, you can visit our web page http://nudge-it.eu/. The project has been reviewed and approved by an academic ethical review committee, following the guidelines of the European Commission.

In case you have any questions about the project, please do not hesitate to contact us by telephone (0221-470-6939) or e-mail (marina.schroeder@uni-koeln.de). In case your child has any dietary restriction (due to an allergy or an intolerance) or if you do not want your child to participate in the study, please fill in the attached sheet and hand it back to the class teacher by XXXXXX.

Thank you a lot in advance
Yours Faithfully,

Prof. Dr. Michèle Belot
School of Economics
University of Edinburgh

Jun.-Prof. Dr. Marina Schröder
Wirtschafts- und Sozial-
wissenschaftliche Fakultät
Universität zu Köln

Martina Vecchi
School of Economics
University of Edinburgh

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50923 Köln

Dietary restrictions

Does your child have any **dietary restriction**?

[Yes] [No]

Please specify below which foods you child **should not eat**:

_____

_____

_____

_____

Exclusion of your child from this study

☐ Tick the box beside if you **do not** want your child to participate to this research study.

Name and surname of the child

_____

_____ _____

Date Signature of parent/carer

Seite 1

Figure 2.4.2: Letter for Parents

Universität zu Köln

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Wirtschafts- und Sozialwissenschaftliche Fakultät

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Telefon +49 221 470-6939
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marina.schroeder@uni-koeln.de
http://www.pwl.uni-koeln.de

Köln, 24.04.2017

Dear Parent/children caretaker

In Kooperation mit:

We are a team of social scientists from the University of Cologne and the University of Edinburgh and we are conducting a **research study on food preferences** at [NAME OF THE SCHOOL.. We would like to invite you to answer a few questions about your child and we would really appreciate if you could answer as many as you can in order to help us conducting our research on food preferences. All the information collected will only be used for research purposes. Each child will be given a unique identifier (a number), that will allow us to keep all information anonymous.

We would be grateful if you could fill in the small questionnaire enclosed and return it to the school by [DATE in two weeks]. The questionnaire is voluntary.

Yours Faithfully,

Prof. Dr. Michèle Belot
School of Economics
University of Edinburgh

Jun.-Prof. Dr. Marina Schröder
Wirtschafts- und Sozial-wissenschaftliche Fakultät
Universität zu Köln

Martina Vecchi
School of Economics
University of Edinburgh

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Albertus-Magnus-Platz
50923 Köln

STUDY "Food Preferences Among Children"

We would be grateful if you could fill in this short survey and return it to the school by [DATE]

Identification _____

Child's age _____

Child's Gender: female ☐ male ☐

Approximate Child's height in cm _____

ApproximateChild's weight in kilos _____

How often does your child eat the following foods?

Dried Fruits

☐ Never ☐ Occasionally (once or twice a **month**) ☐ Often (once or twice a week) ☐ Daily

Fresh Fruits

☐ Never ☐ Occasionally (once or twice a month) ☐ Often (once or twice a week) ☐ Daily

Milk or Yoghurt

☐ Never ☐ Occasionally (once or twice a month) ☐ Often (once or twice a week) ☐ Daily

Sweets (Chocolate, Cakes, Candies, etc.)

☐ Never ☐ Occasionally (once or twice a month) ☐ Often (once or twice a week) ☐ Daily

Savoury snacks (crackers, rice cakes, bread)

☐ Never ☐ Occasionally (once or twice a month) ☐ Often (once or twice a week) ☐ Daily

Please list your child's favourite foods:

_____

_____

At which occasion would your child eat sweets?

- ☐ Only at special occasions (birthdays, …)
- ☐ As a reward for good behaviour
- ☐ As a reward for eating her/his meal
- ☐ No specific occasion; he is eating sweets from time to time
- ☐ S/he never eats sweets

Do you use rewards to encourage specific behaviours from your children?

Yes ☐ No ☐

If Yes, which type of rewards (for example sweets, toys, reading a book together, etc.)?

_____

_____

How often do you use rewards to encourage specific behaviours from your children?

☐ Never ☐ Occasionally (once or twice a month) ☐ Often (once or twice a week) ☐ Daily

Would you like to receive information regarding the results of this research project?

Yes ☐ No ☐

If Yes, please indicate below an adress (email or postal) to which we can send the information regarding the results of this study

_____

_____

Seite 1

Figure 2.4.3: Survey for Parents

2.4.2 Task and Questionnaires

This section presents the translated version from German of the experimental material.

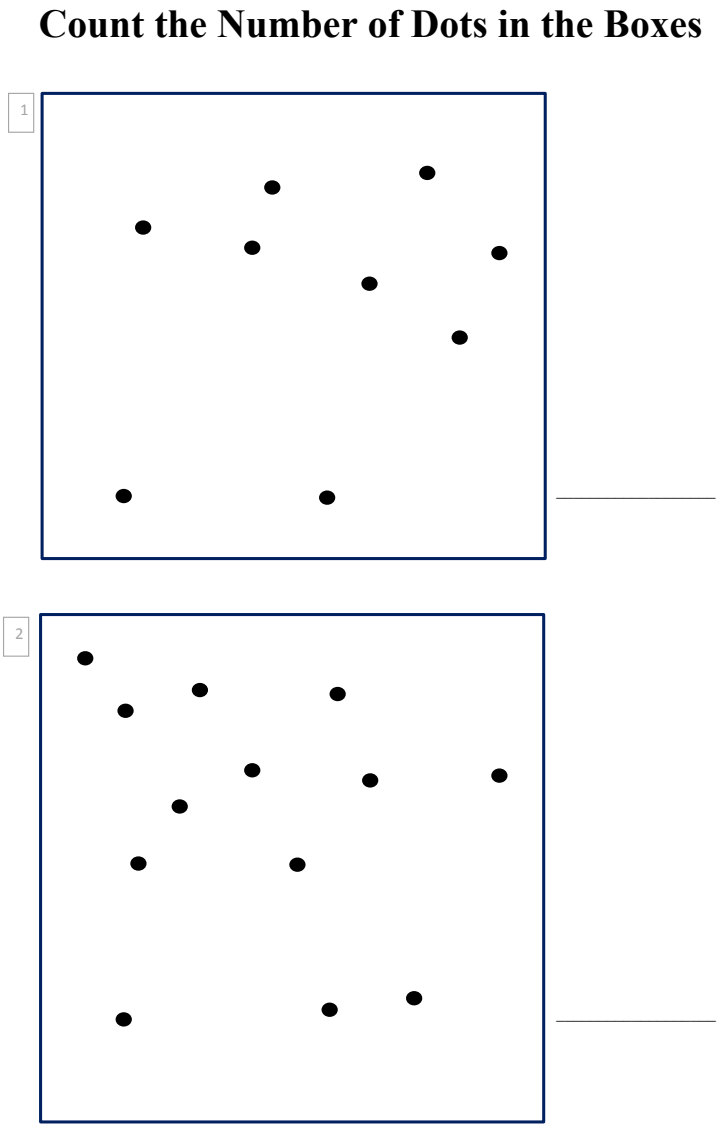

Figure 2.4.4: Example of the task used

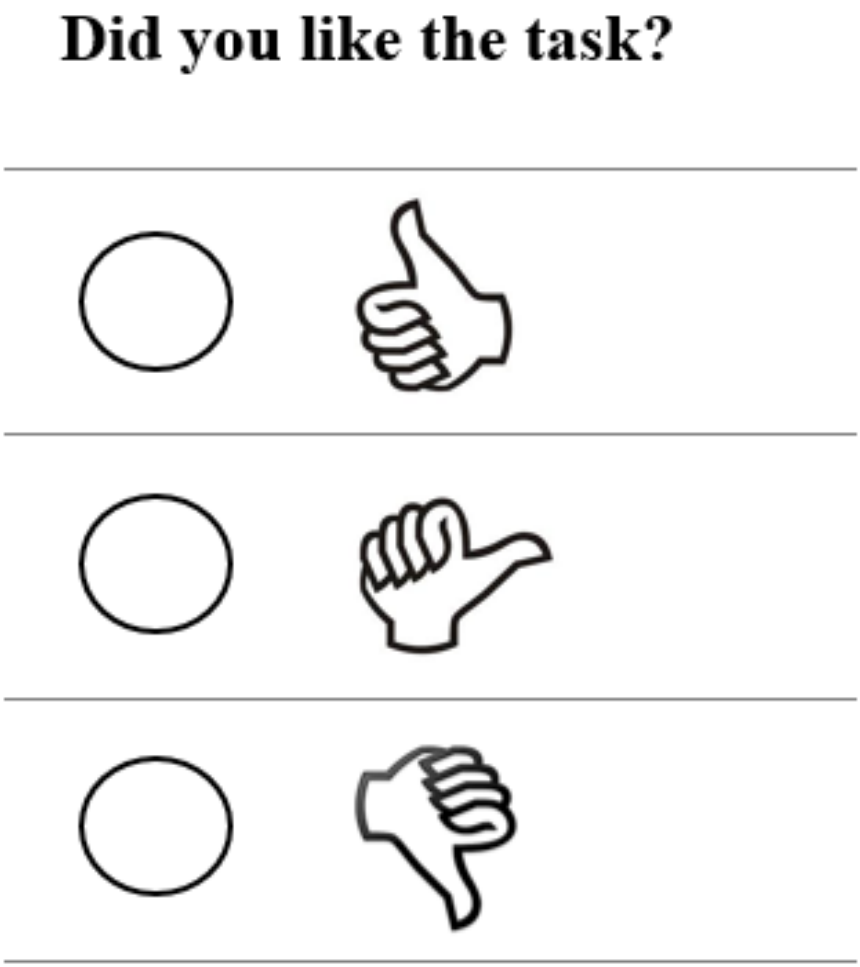

Figure 2.4.5: Questionnaire to assess the valuation for the task

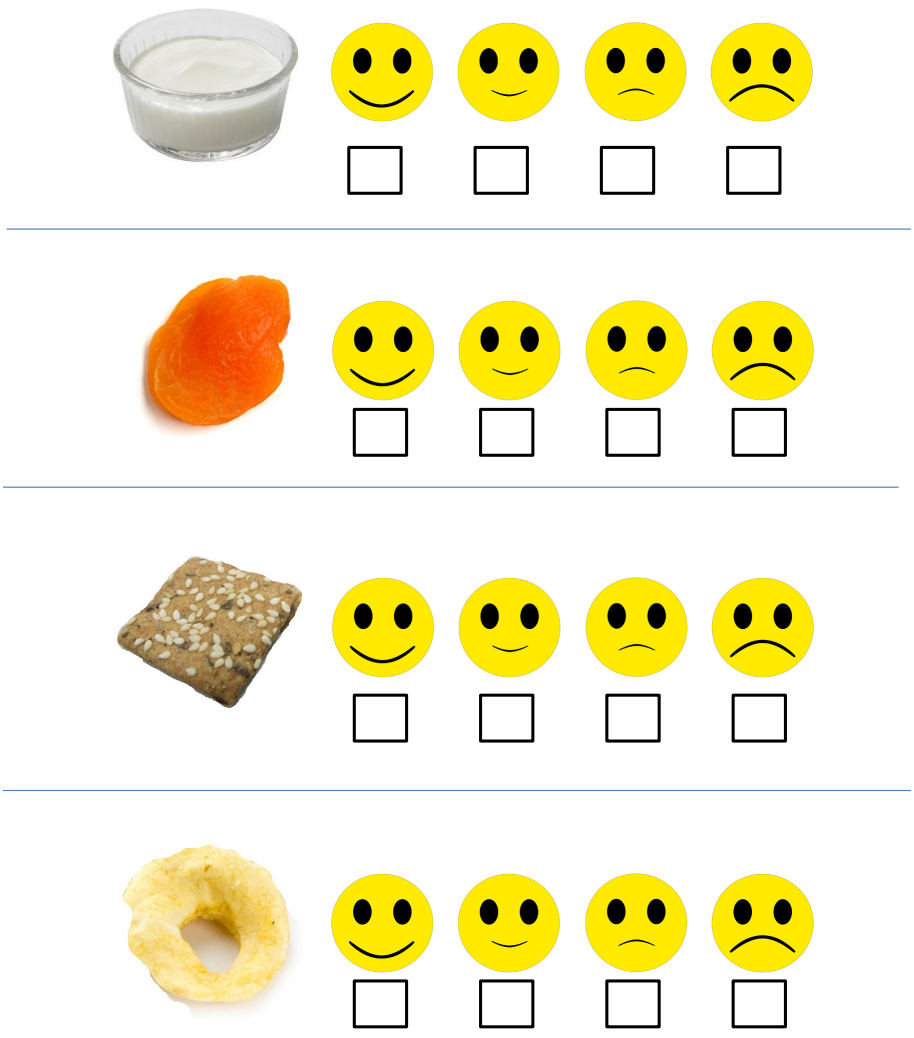

Figure 2.4.6: Questionnaire to assess the liking of the foods

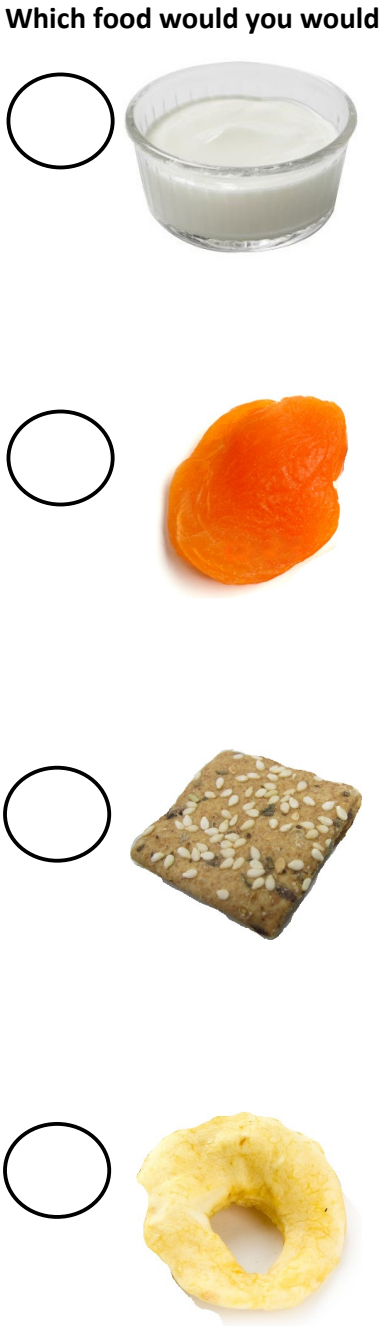

Figure 2.4.7: Questionnaire to determine the choice of the snack

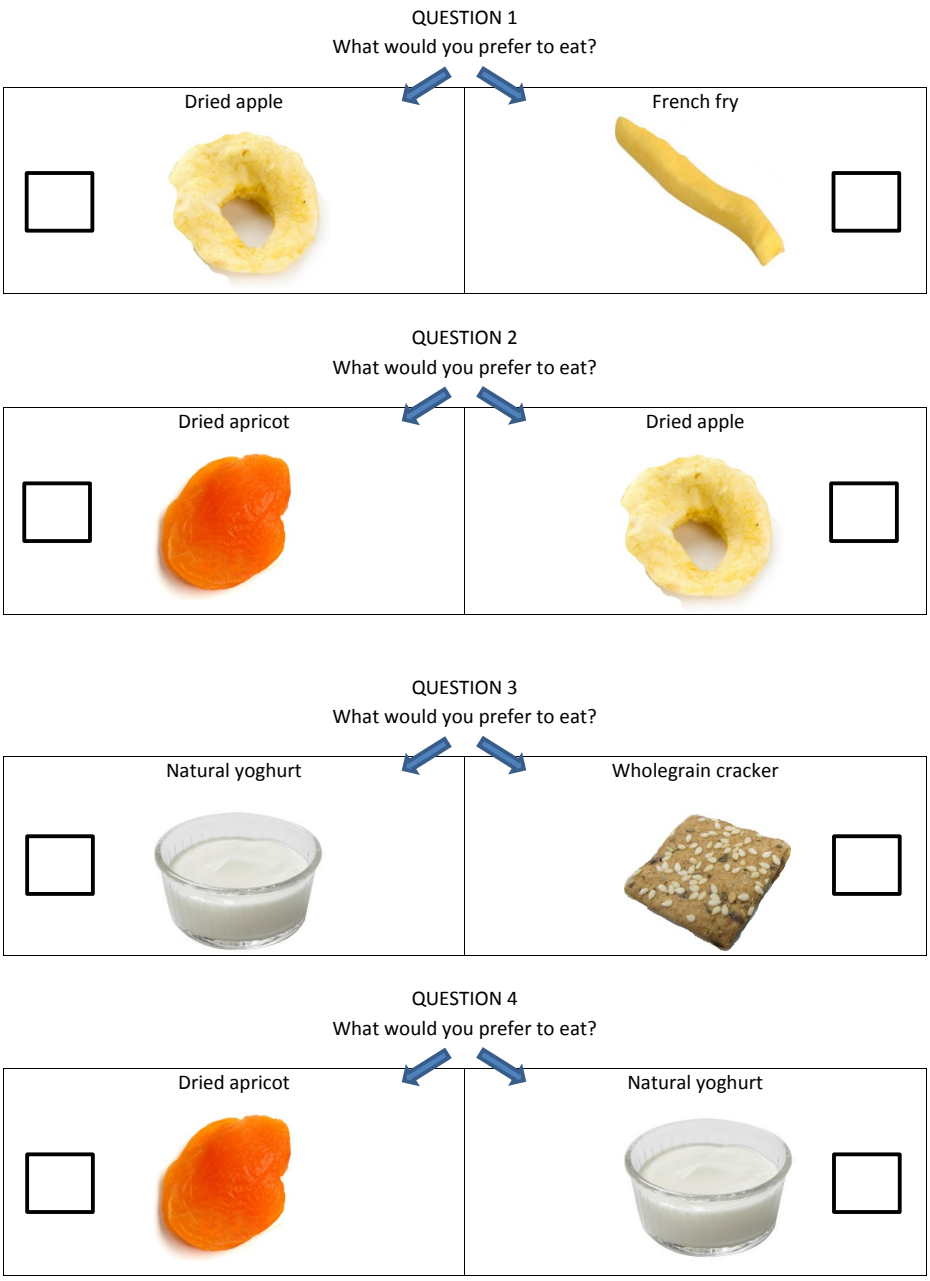

Figure 2.4.8: Questionnaire to assess the liking of the foods

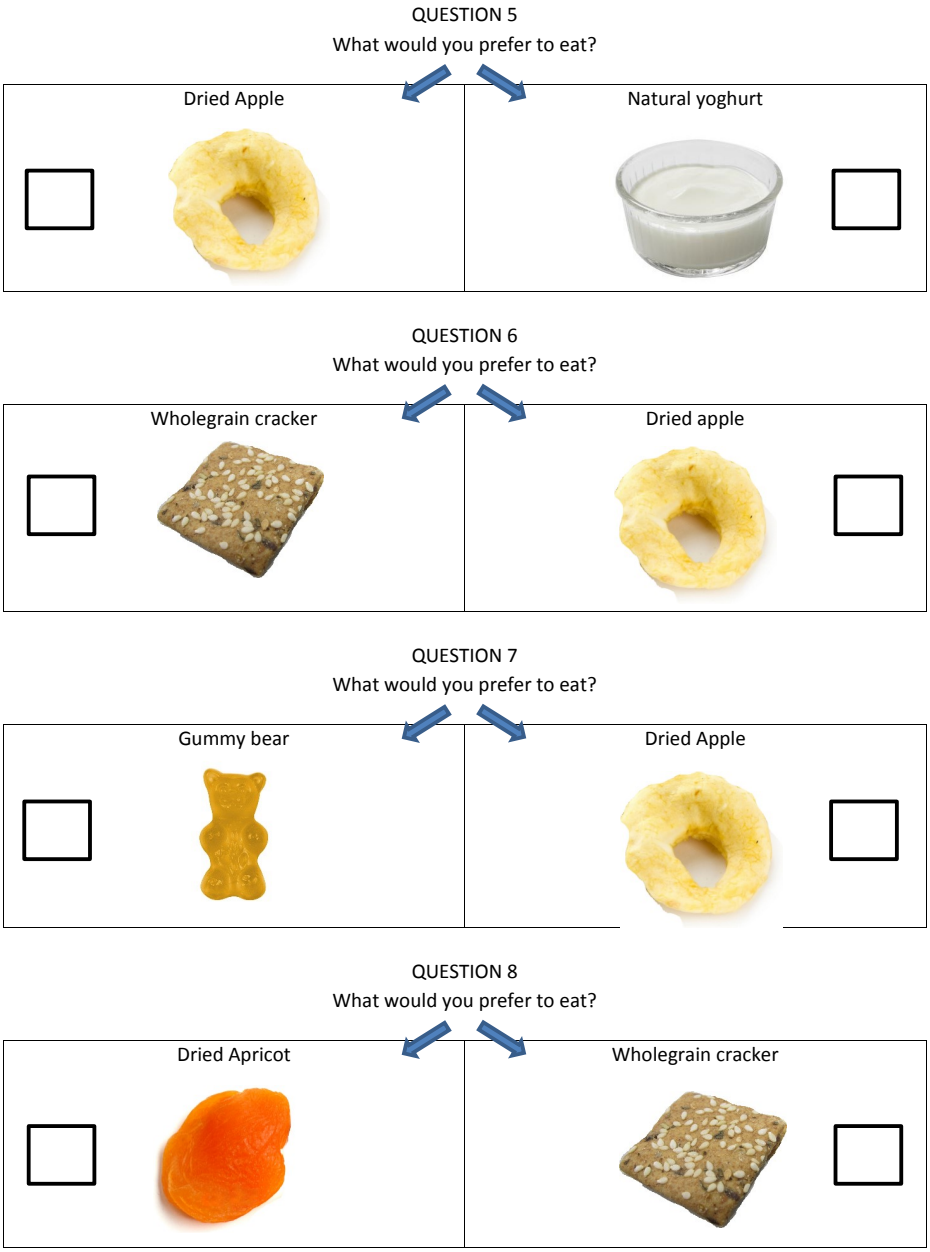

Figure 2.4.9: Questionnaire to assess the liking of the foods

2.4.3 Nutritional Profiles

After assessing children's liking for 10 snacks using the three outcome measures used in the experiment (dried apples, dried apricots, dried prunes, wholegrain crackers, rice cakes, carrot sticks, pears, grapes, drinking yoghurt and natural yogurt), we chose the 4 snacks with similar and more moderate rating. As food reward, we chose the one with the most moderate liking. Those foods were selected because of their nutritional profile: as crackers we used spelt and quinoa wholegrain crackers, the yogurt was natural yogurt without added sugar and the two dried fruits were chosen because they contribute to the RDA for fruits and do not have added sugar (even if they have a high content of sugar).

In table 2.4.1 we report the nutritional profile of the foods.

2.4.4 Correlation Between Different Outcome Measures and Transitivity of Preferences

Table 2.4.2 shows the correlation between the 3 outcomes used to assess the liking of the 4 foods tasted during the assessments. The estimates of the Pearson's correlation coefficient between the different outcome measures for each of the foods show a positive correlation in all the assessments (the coefficients in the bordered boxes), with the majority of coefficients identifying a moderate or strong correlation. The correlation between liking of different foods is generally negative.

Table 2.4.3 reports the number of times the transitivity of preferences in the hypothetical choice between two of the snacks was violated. In each assessment session each child could violate transitivity 24 times, but the maximum amount of intransitive choices per assessment is 7. Half of children has always transitive preferences.

Table 2.4.1: Nutritional Profile of the foods per 100 Grams

	Dried Apples	Dried Apricots	Crackers	Yogurt	Gummy Bears	French Fries
Calories	243	313	427	53	343	316
Total Fat		1 g	15 g	0.1 g	< 0.5	16 g
of which Saturated			2.3 g	0.1 g	< 0.1	2 g
Sodium	87 mg	13 mg	930.2 mg	775.2 mg	27.1 mg	227 mg
Total Carbohydrate	66 g	81 g	53 g	6.9 g	77 g	39 g
Dietary Fiber	9 g	9 g				4 g
Sugar	57 g	69 g	2.4 g	6.9 g	46 g	0 g
Protein	1 g	4 g	15 g	5.5 g	6,9 g	4 g
Vitamin A		94%				0%
Vitamin C	6%	2%				12%
Calcium	1%	7%		185 mg		2%
Iron	8%	19%				5%

Nutrient data for this listing was provided by the by food manufacturers or (when not possible) by the USDA National Nutrient Database for Standard Reference [16]

Table 2.4.2: Pearson's Correlation Coefficients for the Different Outcome Measure

		1st Assessment			**2nd Assessment**			**3rd Assessment**		
		Choice	Comparison	Valuation	Choice	Comparison	Valuation	Choice	Comparison	Valuation
Apple	Choice	1			1			1		
	Comparison	0.166*	1		0.286***	1		0.495***	1	
	Valuation	0.296***	0.324***	1	0.287***	0.420***	1	0.382***	0.404***	1
Apricot	Choice	1			1			1		
	Comparison	0.361***	1		0.433***	1		0.428***	1	
	Valuation	0.207**	0.467***	1	0.269***	0.470***	1	0.207**	0.524***	1
Yogurt	Choice	1			1			1		
	Comparison	.533***	1		0.529***	1		0.583***	1	
	Valuation	0.520***	0.476***	1	0.462***	0.480***	1	0.437***	0.453***	1
Cracker	Choice	1			1			1		
	Comparison	0.545***	1		0.504***	1		0.465***	1	
	Valuation	0.0946	0.175*	1	0.149*	0.152*	1	0.129	0.308***	1

A Pearson's coefficient $0.1 < |r| < 0.3$ indicates small correlation, $0.3 < |r|$ ¡ 0.5 medium/moderate correlation and $|r| > 0.5$ large/strong correlation.

Table 2.4.3: Violations of Transitivity

	Average	Std. Dev.	Maxium
1^{st} Assessment	0.505	1.342	6
2^{nd} Assessment	0.949	1.421	7
3^{rd} Assessment	1.070	1.616	7
Total	2.523	3.173676	15

2.4.5 Attrition

In the main text we present the analysis excluding children who were not in class all 3 assessments. Such analysis yields unbiased estimates as long as children who were not in class during all the 3 assessments are missing at random [5]. In table 2.4.4 we present the results from the linear probability model predicting missing values in the data based on the treatment assignment or liking at baseline. This analysis shows that missing observations do not depend on those variables and are hence missing at random.

Table 2.4.4: Linear probability model predicting missing values in the data

	(1)	(2)	(3)	(4)
		Attrition		
Control *reference*				
Effortless	-0.0472			
	(0.316)			
Effortful	0.0109			
	(0.655)			
Baseline level of:				
Valuation		-0.0133		
		(0.305)		
Choice			0.0275	
			(0.841)	
Comparison				0.0215
				(0.454)
Constant	0.186***	0.160***	0.139***	0.118***
	(0.000)	(0.003)	(0.000)	(0.007)
N	214	203	206	205

Notes: binary dependent variable =1 if at least 1 of 3 outcomes is missind during at least 1 assessment

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.4.6 Regression with the full sample

Table 2.4.5 presents the results of the OLS analysis of the impact of treatment and effort on liking of the food reward without the exclusion of children not in class all the 3 assessments.

Table 2.4.5: Regression Results with the Full Sample

	(1)	(2)	(3)	(4)	(5)	(6)
		(Short-term)			(Long-term)	
	Choice	Valuation	Comparison	Choice	Valuation	Comparison
Treatment	-0.0129	0.264*	-0.102	-0.00135	-0.0713	0.0248
	(0.717)	(0.079)	(0.170)	(0.970)	(0.774)	(0.832)
High-Effort	0.0155	-0.0895	0.0135	-0.00563	-0.209	-0.0347
	(0.539)	(0.611)	(0.854)	(0.880)	(0.345)	(0.765)
Baseline	0.256*	0.693***	0.530***	0.0568	0.646***	0.515***
	(0.061)	(0.000)	(0.000)	(0.499)	(0.000)	(0.000)
School 1	ref.	ref.	ref.	ref.	ref.	ref.
School 2	0.0275	0.0479	0.0242	-0.0212	0.346	0.0118
	(0.477)	(0.684)	(0.772)	(0.671)	(0.136)	(0.930)
School 3	-0.00290	0.175	0.0254	-0.0331	0.478**	0.0415
	(0.920)	(0.174)	(0.797)	(0.471)	(0.033)	(0.790)
Constant	0.0235	0.312**	0.229**	0.0568	0.602**	0.199
	(0.416)	(0.048)	(0.034)	(0.112)	(0.034)	(0.168)
N	195	191	194	192	188	191

Notes: p-values clustered on the class level in Columns (1), (2) and (3) refer to the second assessment columns (4), (5) and (6) to the follow-up. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.4.7 Results from linear regression with different standard errors

In table 2.4.6 is presented the OLS regression analysis performed in the main text, with the use of three different methods for computing the standard errors. It shows the results with clustered standard errors on the class level following [38], clustered standard errors on the class level using bootstrapping method by [14] [13] and heteroscedastic robust unclustered standard errors. The use of the 3 methods does not lead to significantly different results.

Table 2.4.6: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
		(Short-term)			(Long-term)	
	Choice	Valuation	Comparison	Choice	Valuation	Comparison
Reward	0.0883	0.29	0.567	0.123	-0.0624	0.543
	(0.011)	**(0.056)**	**(0.001)**	**(0.021)**	(0.795)	**(0.001)**
	[0.054]	[0.182]	**[0.030]**	**[0.062]**	[0.806]	**[0.001]**
	{0.140}	{0.107}	**{0.002}**	{0.103}	{0.748}	**{ 0.007}**
High-effort	-0.0282	-0.0301	-0.250	0.0285	-0.195	-0.139
	(0.455)	(0.838)	**(0.065)**	(0.658)	(0.281)	(0.375)
	[0.192]	[0.842]	[0.132]	[0.722]	[0.422]	[0.492]
	{0.599}	{0.874}	{0.173}	{0.700}	{0.316}	{0.558}
Baseline of:	0.540	0.609	0.496	0.403	0.509	0.526
	(0.002)	**(<0.001)**	**(0.001)**	**(0.005)**	**(<0.001)**	**(<0.001)**
	[<0.001]	**[<0.001]**	**[<0.001]**	**[<0.001]**	**[<0.001]**	**[<0.001]**
	{<0.001}	**{<0.001}**	**{<0.001}**	**{0.008}**	**{<0.001}**	**{<0.001}**
School 1	ref.	ref.	ref.	ref.	ref.	ref.
School 2	-0.114	0.150	0.338	-0.00807	0.0694	0.438
	(0.020)	(0.276)	**(0.017)**	(0.904)	(0.759)	**(0.010)**
	[0.122]	[0.456]	**[0.078]**	[0.810]	[0.752]	**[0.060]**
	{0.068}	{0.504}	**{0.094}**	{0.925}	{0.757}	**{0.075}**
School 3	-0.0809	0.177	0.147	-0.0686	0.504	0.222
	(0.081)	(0.110)	(0.193)	(0.405)	**(0.053)**	(0.200)
	[0.274]	[0.166]	[0.284]	[0.598]	[0.174]	[0.408]
	{0.202}	{0.393}	{0.439}	{0.367}	**{0.017}**	{0.291}
Constant	0.109	1.206	0.647	0.137	1.785	0.910
	(0.009)	**(<0.001)**	**(<0.001)**	**(0.029)**	**(<0.001)**	**(<0.001)**
	[0.212]	**[<0.001]**	**[<0.001]**	**[<0.001]**	**[0.008]**	**[<0.001]**
	{0.061}	**{<0.001}**	**{<0.001}**	**{0.062}**	**{<0.001}**	**{<0.001}**
N	177	177	177	177	177	177

Notes: *p*-values below the coefficients based on: () clustered standard errors on the class level following [38]; [] clustered standard errors on the class level using bootstrapping method by [14] [13]; heteroscedastic robust unclustered standard errors. P-values below 0.1 in bold. Columns (1), (2) and (3) refer to the second assessment, columns (4), (5) and (6) to the follow-up.

2.4.8 Results from linear regression with different foods

This section presents the OLS regression analysis of the impact of the treatment and of higher effort on the liking for the 3 food tasted in the assessment sessions but not used in the treatment sessions (placebo foods). The regression analysis for the placebo foods shows a non significant effect of the treatment and of higher effort on their liking, as expected.

Table 2.4.7: Regression Results for Dried Apricots

	(1)	(2)	(3)	(4)	(5)	(6)
		(Short-term)			(Long-term)	
	Choice	Valuation	Comparison	Choice	Valuation	Comparison
Treatment	-0.0139	0.203	-0.0921	0.000586	-0.0583	0.0542
	(0.727)	(0.151)	(0.165)	(0.988)	(0.812)	(0.633)
High- effort	0.0196	-0.0913	0.0186	-0.00561	-0.180	-0.0399
	(0.478)	(0.641)	(0.803)	(0.889)	(0.440)	(0.750)
Baseline:	0.254*	0.687***	0.548***	0.0533	0.630***	0.529***
	(0.063)	(0.000)	(0.000)	(0.530)	(0.000)	(0.000)
School 1	ref.	ref.	ref.	ref.	ref.	ref.
School 2	0.0304	0.0273	0.0651	-0.0231	0.402*	0.0292
	(0.485)	(0.823)	(0.459)	(0.674)	(0.086)	(0.838)
School 3	-0.00377	0.206	0.0694	-0.0386	0.446**	0.0497
	(0.907)	(0.131)	(0.497)	(0.437)	(0.041)	(0.749)
Constant	0.0255	0.379**	0.187*	0.0618	0.635**	0.163
	(0.442)	(0.029)	(0.079)	(0.123)	(0.024)	(0.269)
N	177	176	177	177	176	177

Notes: p-values clustered on the class level in Columns (1), (2) and (3) refer to the second assessment columns (4), (5) and (6) to the follow-up. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.4.8: Regression Results for Natural Yogurt

	(1)	(2)	(3)	(4)	(5)	(6)
		(Short-term)			(Long-term)	
	Choice	Valuation	Comparison	Choice	Valuation	Comparison
Treatment	-0.0467	-0.137	-0.157	-0.0812	-0.116	-0.313**
	(0.702)	(0.461)	(0.268)	(0.470)	(0.467)	(0.043)
High-effort	-0.0528	-0.106	0.230*	-0.0263	0.0562	0.223
	(0.625)	(0.461)	(0.067)	(0.809)	(0.730)	(0.127)
Baseline:	0.466***	0.621***	0.606***	0.394***	0.585***	0.638***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
School 1	ref.	ref.	ref.	ref.	ref.	ref.
School 2	0.129	0.238	0.238**	0.118	0.207	0.138
	(0.285)	(0.278)	(0.045)	(0.281)	(0.255)	(0.282)
School 3	0.142	0.250	0.162	0.136	0.250	0.0969
	(0.281)	(0.270)	(0.233)	(0.215)	(0.230)	(0.542)
Constant	0.183	1.387***	0.546**	0.204	1.533***	0.582**
	(0.245)	(0.001)	(0.018)	(0.105)	(0.000)	(0.028)
N	176	170	177	176	170	177

Notes: p-values clustered on the class level in Columns (1), (2) and (3) refer to the second assessment columns (4), (5) and (6) to the follow-up. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.4.9: Regression Results for Cracker

	(1)	(2)	(3)	(4)	(5)	(6)
		(Short-term)			(Long-term)	
	Choice	Valuation	Comparison	Choice	Valuation	Comparison
Treatment	0.0231	-0.0996	-0.155	-0.00902	-0.0244	-0.260**
	(0.851)	(0.166)	(0.158)	(0.934)	(0.552)	(0.012)
High-effort	0.0553	0.0584	-0.00995	-0.00966	-0.0606	-0.0266
	(0.627)	(0.594)	(0.927)	(0.928)	(0.337)	(0.870)
Baseline:	0.560***	0.343***	0.613***	0.440***	0.0287	0.656***
	(0.000)	(0.009)	(0.000)	(0.000)	(0.408)	(0.000)
School 1	ref.	ref.	ref.	ref.	ref.	ref.
School 2	-0.102	0.0172	-0.147	-0.121	-0.0288	-0.235**
	(0.397)	(0.872)	(0.203)	(0.167)	(0.535)	(0.032)
School 3	-0.0761	0.0984	-0.0759	-0.0434	0.0131	-0.0311
	(0.571)	(0.434)	(0.454)	(0.700)	(0.772)	(0.821)
Constant	0.158	2.545***	0.938**	0.197*	3.857***	0.856***
	(0.294)	(0.000)	(0.018)	(0.056)	(0.000)	(0.002)
N	176	173	177	176	173	177

Notes: p-values clustered on the class level in Columns (1), (2) and (3) refer to the second assessment columns (4), (5) and (6) to the follow-up. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Chapter 3. Stress and Food Preferences: A Lab Experiment with Mothers

We present evidence from a laboratory experiment on the effects of stress induced in the lab on food consumption among 196 low-income mothers in the UK. In the stress treatment, subjects were asked to complete a 10 minute block of short incentivised decision tasks designed to mimic stressors often experienced by low-socioeconomic mothers. We evaluate the effects of the stressful task on immediate and planned food consumption, and specifically on the nutritional content of the foods chosen. Immediate consumption is measured by in-laboratory consumption of a low calorie and high calorie snack; planned consumption is measured by incentivised food purchases in a specifically designed food choice tool. Measurements of participants' salivary cortisol and heart rate were taken over the course of the experimental sessions to assess the stressfulness of the stress task. Contrary to previous findings in the literature, we find no evidence of an effect of the stress induced in the lab on the nutritional content of immediate or planned food choices. When controlling for the performance in the stress task though, we find a higher calorie intake among those performing poorly,

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suggesting a role of failure in eating behaviour.

3.1 Introduction

The spread of obesity in developed nations over the past decades has disproportionally affected lower socioeconomic groups as they face a larger risk of overweight and obesity [21, 9]. These groups experience more stress and negative affective states, which may lead to short-sighted and less attentive decision-making [16, 6]. Higher levels of stress and a lack of tools to cope with stressful situations among low socioeconomic groups are among the factors suggested to cause this socioeconomic gradient in obesity [4, 8].

Descriptive evidence has shown (some) individuals exposed to chronic stressors to have a less balanced diet and an increased calorie intake [29]. Experimental evidence regarding the impact of acute stress on dietary choices is somewhat mixed. Lab experiments by Zellner et al. [32], Habhab et al. [14] and Rutters et al. [25] have shown acute stress to shift individuals' food choices towards a less healthy diet with higher consumption of sugars and fat and a higher total calorie intake.[1] A study by Appelhans et al. [3] on the other hand has found no evidence of such a shift and Zellner et al. [33] have shown male undergraduate students to make healthier choices when exposed to an experimental stressor. Gender [33], emotional eating [24], anxiety following the stressor and disinhibition [25] have been reported to affect the susceptibility of individuals' diet to acute stress. Studies by Epel et al. [12] and Newman et al. [23] furthermore suggest cortisol might play a vital role in the link between stress and dietary behaviours, their findings show significant changes in food choices only among participants with a strong cortisol response to stress.

[1] Table 3.6.1 in Appendix 3.6.1 reports an overview of the previous experimental literature.

One potential cause of this variation in cortisol reactivity and in dietary responses to stress is the abilitiy to cope with stress [23].

This study examines the relationship between acute stress[2] , coping abilities and dietary choices, with a focus on low-income mothers. We focus on mothers as they play a crucial role in families' dietary choices, often they are in charge of the family's food shopping and meal preparation [15]. Maternal food choices hence have considerable spillover effects on the diet of their children [19]. We furthermore focus on low-income families as they are subject to higher risks of overweight and obesity [9]. Using a lab experiment, we study the effects of acute stress and coping abilities on food choices, both in the context of immediate consumption (a "snack choice") and planned consumption (a "food shopping choice"). A novel stress protocol was designed to mimic stressors often experienced by low-socioeconomic mothers: making decisions with consequences for others (e.g. for the family) subject to financial and time constraints as well as distractions (e.g. by children requiring attention). Previous laboratory experiments examining the impact of acute stress on food choices have used artificial and unrealistic stressors (solving arithmetical tasks, preparing a speech for an audience etc.). The cortisol and perceived stress responses to these stressors is marked, but in our opinion does not resemble the responses to stressors often faced by our subjects. Also, the focus of previous laboratory experiments was on immediate consumption choices. Food choices made in supermarkets and shops, however, are not aimed at immediate consumption and hence are based on different decision processes.

We propose two channels through which stress might affect food choices: (1) by

[2]Acute stress is the most common form of stress. It comes from demands and pressures of the recent past and anticipated demands and pressures of the near future. It is defined in contrast to chronic stress, which results from repeated exposure to situations that lead to the release of stress hormones.

affecting individuals' preferences and (2) by affecting their ability to make sound decisions. Hormonal responses to stress have been frequently cited to cause cravings for energy-dense "comfort foods" and hence a (temporary) change in food preferences [1]. Both acute and chronic stress stimulate the release of cortisol (in humans) or of other glucocorticoids (in animals) in the hypothalamic-pituitary-adrenal (HPA) axis which in turn have been shown to affect food intake of rats [31, 10] and humans [28, 13] when administered exogenously. These stress-induced temporary food cravings constitute an endogenous change of individuals' food preferences.

On the other hand, stress can be a drain on resources such as mental energy and time, which in a bounded rationality context are necessary to make sound decisions [2]. Low-socioeconomic groups are already depleted of their cognitive capacity, since poverty concerns consume mental resources [20, 16]. A stress-induced drain on resources is hence expected to amplify the impairment of decision-making processes due to scarcity, as described by Mullainathan and Shafir [22]. Experimental evidence shows cognitive overload to weaken self-control and lead to less healthy food choices [26]. Stress has furthermore been found to temporarily alter time preferences and risk attitudes [11, 17] thereby affecting the ability to make decisions which optimize long-term utility.

The relative importance of these two proposed channels is expected to differ between food shopping and immediate consumption choices. Stress-induced food cravings (first channel) are likely to play a somewhat smaller role for shopping than for immediate consumption choices. As shopping choices require planning of future consumption and often involve larger choice sets, impaired decision making (second channel) would be expected to affect these choices more than the less complex consumption choices. Comparison of the impact of stress on immediate and planned consumption will therefore allow us to assess the relative importance of the chan-

nels proposed. We furthermore randomly vary the complexity of the experimental food shopping choice, allowing us to examine the relevance of the second channel for planned consumption choices.

To study the impact of acute stress on dietary choices and to understand the mechanisms linking them, we conducted a lab experiment with 196 mothers in Colchester (UK). We employed a 2x2 experimental design with a pre-assignment of experimental conditions at the lab session level. In a first stage, sessions were pre-assigned to the stress treatment or to the control group. In the stress treatment, participants were asked to complete a 10-minute block of short incentivised decision tasks. While the tasks were completed individually, incentives were based on the joint performance of randomly assigned "social groups" of two participants to elicit social stress. Incorrect answers and incomplete tasks were penalized. Time pressure was induced by the tight overall time limit as well as by time penalties and time limits per task. Short incentivised knowledge questions appeared randomly on screen over the course of the task block to induce additional stress through distractions. In the control group, participants were asked to read several short texts on a variety of topics and answer simple non-incentivised questions about these texts. The effectiveness of our stress protocol was tested using survey questions on the participants' perceptions of the tasks as well as the change in heart rate and salivary cortisol in response to the tasks.

In a second stage, sessions were further pre-assigned to one of two food shopping environment treatments: a simple or a complex choice environment. If stress affects dietary choices by impairing individuals' decision-making, a more complex choice environment is expected to lead to less healthy food shopping choices. Participants were asked to use a fixed budget to purchase food items in a "virtual supermarket",

a computer-based tool similar to online supermarkets. A variety of high-calorie and low-calorie food and drink items was available to choose from with prices matching market prices at a local supermarket. The presentation of options varied between the two treatment groups: in the simple choice environment, items were displayed in 10 different categories (e.g. fruit, vegetable, dairy etc.). In the complex choice environment, items were displayed in a long list, grouped by category but without labelling of categories. The nutritional content of the chosen basket of food and drink items is used to determine the impact of acute stress and the choice environment on the healthiness of food shopping choices.

Following the before mentioned food shopping choice, participants were given a five minute break and then asked to complete a questionnaire on demographics and other control variables. A choice of snacks involving high- and low-calorie snack foods was placed in bowls on each participant's desk for consumption during the break and during the completion of the questionnaire. The amount of each snack type consumed by each participant was recorded by weighing the snack bowls before and after the snacks were available. The resulting quantities are used to determine the impact of acute stress on the healthiness of snacking choices.

Participants in the stress group perceived the task as significantly more stressful than the control group; this is supported by a significant rise in their heart rate during the task. However, we find no statistically significant effects of this acute stressor on participants' immediate food consumption ("snack choice") or planned food consumption ("shopping choice"). Our results suggest that day-to-day stress per se does not affect dietary choices. When controlling for the performance in the stress task though, we find a higher calorie intake among those poorly, suggesting a role of failure in eating behaviour.

Additional data collected during this lab experiment [5] show chronic maternal stress

during pregnancy to be linked with less healthy children's food preference and food consumption patterns. Taken together, these findings indicate that a mother's stress has little impact on her dietary choices, but can have a significant impact on the development of children's food preferences and hence their future food behaviours.

This paper is structured as follows: Section 3.2 presents the experimental design. Section 3.3 describes the data collected during the experiment. In section 3.4 we present our empirical analysis and our results. Section 3.5 shows explorative evidence on the combined dietary impact of acute stress and failure. Section 3.6 concludes.

3.2 Experimental Design

To study the relationship between maternal stress and food preferences, we conducted a lab experiment with 227 low-income mothers in Colchester, UK.[3] The sessions for this experiment took place between 15 October and 19 October 2018 in the experimental laboratory of the University of Essex (EssexLab). Sessions lasted approximately two hours and started at 10:30 am, 2:00 pm and 5:00 pm. We employ a between subject design, with participants only attending one session. The session slots were pre-assigned to the four experimental conditions. Additional survey data not presented in this chapter were collected during this lab experiment, to study the impact of chronic maternal stress during pregnancy on children's food preference and food consumption patterns [5].

The experimental design was pre-tested in June 2018 using a sample of 50 low-income

[3]The lab experiment was conducted with ethical approval by the European University Institute and the University of Edinburgh. The experiment and the hypotheses tested in this study and in Belot et al. [5] were pre-registered in the AEA RCT registry under the following trial ID: AEARCTR-0003410. Details can be found under https://www.socialscienceregistry.org/trials/3410/history/35937.

mothers in Florence, Italy[4]. Initially this pre-test was planned as the main experiment, but recruitment of participants proved too difficult to reach the necessary sample size.

3.2.1 Sample and Recruitment

We recruited low-income mothers living in the area of Colchester. The specific eligibility criteria for participation in the study were:

1. Aged between 18 and 45
2. Fluent in English
3. Being a mother whose youngest child is aged between 2 and 12 years old
4. Net annual household income below £35.000
5. Does not hold a university degree and is not currently enrolled at university
6. Has not been pregnant in the past 6 months
7. Has no allergies or intolerances to foods used for the snack consumption choice
8. Does not have medical conditions which can affect diet

Participants were recruited using multiple channels. A direct marketing agency sent personalized letters to women in the Colchester area who match our age restriction and live in a low SES neighbourhood. The study was furthermore promoted to the participants of a previous experiment. Examples of the recruitment materials used

[4]The pre-test was conducted with ethical approval by the European University Institute and the University of Edinburgh and was pre-registered in the AEA RCT registry under the following trial ID: AEARCTR-0003089. Details can be found under https://www.socialscienceregistry.org/trials/3089/history/30976.

to advertise the study can be found in Appendix A. Those interested in participation were invited to complete an online screening questionnaire or to contact the experiment team by telephone. Eligible mothers were then invited to one of the experimental sessions; they received an information leaflet and a consent form by post.

31 of the 227 experiment participants did not fulfil all eligibility criteria and are hence excluded from the analysis, a sample of 196 low-income mothers remains for our analysis, see Table 3.2.1 for details.

Table 3.2.1: Sample size

	Stress		**Control**		**Total**
	Categorized	**Long**	**Categorized**	**Long**	
Total:	63	58	60	46	227
Not eligible due to:					
- Child's age	0	1	1	0	2
- HH income	0	0	1	1	2
- University degree	0	0	1	0	1
- Food allergy / intolerance	1	2	1	3	7
- Medical condition (diet-related)	2	0	0	0	2
- Depression	2	6	7	2	17
Eligible:	58	49	49	40	196

3.2.2 Randomisation

We conducted 15 experimental sessions with 13 to 18 participants per session. The 15 sessions were spread over a period of five days. The experiment follows a 2x2 experimental design resulting in four experimental conditions:

1. Stress Task & Simple Shopping Choice

2. Stress Task & Complex Shopping Choice

3. Control Task & Simple Shopping Choice

4. Control Task & Complex Shopping Choice

These experimental conditions were pre-assigned at the session level aiming to ensure balance in terms of day of the week and time of day. When signing up for participation in the experiment, participants were asked to indicate their preferred session slots, but were not informed of the treatments associated with each time slot. If participants indicated availability for multiple slots, they were assigned to one of the slots solely based on scheduling concerns.

3.2.3 Procedure

Upon arrival at our lab facilities, participants' body weight and body height without shoes and heavy clothing was measured by trained lab assistants. Throughout the experimental session, participants were asked to wear an armband monitoring their heart rate using an optical sensor. At the beginning of the experimental session, participants were asked to provide a first saliva sample (9 mins before the start of the stress / control task).

Following this, participants were asked to complete a 10-minute task. The nature of the task depended on the session's randomly assigned experimental condition. In conditions 1) and 2) (detailed above), i.e. the stress treatment groups, participants were asked to complete an incentivised task aimed at inducing mild stress. In conditions 3) and 4), i.e. the control groups, participants were asked to complete a task of similar nature but with no stress inducing features. Detailed descriptions of these tasks can be found below.

Following the first task, participants were asked to complete a "food shopping" task.

They were given a fixed budget of £30 to purchase grocery items in a "virtual supermarket", a computer-based tool similar to online supermarkets. The complexity of the food shopping environment depended on the experimental condition assigned to the session. In conditions 1) and 3) (detailed above), i.e. the simple shopping choice, products were listed separately in 10 different food categories. In conditions 2) and 4), i.e. the complex shopping choice, products were shown in a single long list. Details of this food shopping choice are outlined below.

After the "food shopping" task, participants were asked to provide a second saliva sample (29 mins after the start of the stress / control task) and then given a five minute break. After the break, participants were asked to complete a questionnaire on demographics, family characteristics and behaviours, which might affect cortisol levels. During the break and the time given to complete the first questionnaire, participants were given permission to consume the snacks provided on their desks: high-calorie blueberry mini-muffins and low-calorie apple slices (not labelled with their calorie content or in any other way). After 20 minutes, the bowls of snacks were collected.

Participants were then asked to complete a second questionnaire. The questionnaire featured questions about food consumption and food preferences of the participant and their youngest child as well as the participant's food consumption during pregnancy. The questionnaire furthermore included questions about the stressfulness of the stress/control task, chronic stress, participants' coping behaviours when dealing with stress and about potentially stressful events during the last 3 months as well as during the pregnancy. The data collected in this questionnaire is used in Belot et al. (2018) to examine the link between chronic maternal stress during pregnancy and children's food preferences.

At the end of the experimental session, a final saliva sample was collected (85 mins

after the start of the stress / control task). Before receiving their payment, participants were told that the snacks provided differed in calorie content (at the request of the ethics committee).

Table 3.2.2: Experiment Timeline

1-	Body measurements & HR watches
2-	1st Saliva Sample (baseline)
3-	Stress / Control Task (10 min Task)
4-	Food Shopping Choice (10 min Shopping)
5-	2nd Saliva Sample (25 mins after stressor onset)
6-	Offered bowls of Low and high calorie snacks
7-	1st Questionnaire (demographics, time & risk preferences)
8-	Collection of bowls of Low and high calorie snacks
9-	2nd Questionnaire (food preferences and consumption, stressfulness of the task and experience of stressors, coping abilities, emotional eating)[a]
10-	3rd Saliva Sample (75 mins after stressor onset)

[a] The questionnaire featured several questions to examine the link between chronic maternal stress during pregnancy and children's food preferences.

3.2.4 Treatments

One concern with previous studies that have found an effect of stress on dietary choices is their use of artificial stressors (for example, the Trier Social Stress Test by Kirschbaum et al. [18], or arithmetic exercises). This makes it difficult to extrapolate from those to real life situations low SES individuals may face.

We introduce a novel protocol aimed at inducing in mothers the stress they are often exposed to in real life, and analyse the impact of this type of stress on their behaviours. We ask mothers to solve a series of time and money budgeting task, choosing the cheapest or the most time efficient option amongst all, as often required in real life. We induce stress by introducing monetary penalisation for incorrect or incomplete tasks. To increase stress, we introduce distracting pop-ups questions, unrelated to the main task. Finally, we induce stress through time pressure and through social pressure, by using a group-based incentive scheme. A detailed description of the treatments follows below.

In the stress treatment, participants were asked to complete a 10-minute block of short incentivised decision tasks. While the tasks were completed individually, incentives were based on the joint performance of "social groups", to elicit social stress. Each group consisted of two participants in the same session, which were randomly matched and anonymous, for ethical motives. Incorrect answers and incomplete tasks were penalized. Time pressure was induced by the tight overall time limit as well as by time penalties and time limits per task. Short incentivised knowledge questions appeared on screen throughout the course of the task block at pre-specified times unknown to participants, to induce additional stress through distractions. As mentioned above, this stress protocol was designed to mimic stressors often experienced by low-socioeconomic mothers: making decisions with consequences for others (e.g. for the family) subject to financial and time constraints as well as distractions (e.g. by children requiring attention).

After an initial instruction period, participants were asked to complete a block of 15 short decision tasks on the lab computers. Sample screenshots of the stress tasks are shown in Figures 3.6.4 and 3.6.7 of Appendix 3.6.3. They were given 10 minutes

to complete as many tasks as they could. This overall time constraint was expected to be binding for a majority of the participants and hence to induce time pressure. 64.5% of participants in the stress group did not complete all 15 tasks. Participants also faced individual time limits of 120 seconds for each of the 15 tasks. A countdown timer at the top of the screen indicated how much time they had left for the current task. The timer turned red after 70 seconds to indicate that time was running out and that an initial pay-off deduction (after 75 seconds, details below) was imminent. If participants had not submitted an answer after 120 seconds, their current answer was submitted automatically and the next task appeared.

The decision tasks comprised budget tasks and time management tasks. For the budget tasks, participants were asked to choose the cheapest way to purchase a given basket of household expenditure items from a list of options. For example, participants were asked to purchase five t-shirts choosing from a list of t-shirts, which included single items as well as value packs consisting of multiple items. For the time management task, participants were given a list of diary items and were asked to schedule these in a timetable provided. The items to be scheduled were of different lengths and a variety of constraints needed to be considered when scheduling them: some items needed to be scheduled at a specific time or within some given time window. These types of decision tasks were chosen to reflect prominent aspects of decisions faced by low-income mothers: limited financial and time resources.

To induce additional stress through distractions, 10 simple knowledge questions appeared as pop-ups on screen throughout the block of tasks. The pop-ups were programmed to appear at predetermined times within the 10 minutes, no matter what task was currently shown and how much time had elapsed on this task[5]. When a pop-up was open, participants could not see or continue their work on the current

[5]Pop-ups were programmed to appear 20, 70, 130, 180, 230, 280, 360, 440, 490 and 540 seconds after the beginning of the 10 minute block of tasks.

task until they submitted an answer; however, the countdown timer for the current task was visible and continued to run down. The knowledge questions in the pop-ups were chosen such that a majority of participants would know the answer (e.g. "What is the capital of the UK?"). Stress was not to be induced by the difficulty of the questions, but by the interruption of the current task and the added time pressure. Participants in the stress treatment were randomly assigned to "social groups" of two. While participants needed to complete the tasks individually, they were incentivised jointly. Each group was initially allocated £30, the maximum joint incentive they could earn in the stress task block. The performance of each group member in the decision tasks and the pop-up knowledge questions determined how much of the initial £30 was "lost" by the group. This joint incentive structure was chosen to induce social stress as participants feel that their choices have consequences for others. We chose to frame the incentives in terms of "losses" rather than "gains" to avoid inducing positive emotions. Each participant could lose a maximum of £15 to the group, £13.50 from the decision tasks and £1.50 from the pop-up knowledge questions. In each of the 15 decision tasks, a participant could lose up to £0.90 to the group. There was no loss if the correct answer was submitted within 75 seconds of starting a decision task. If a correct answer was given more than 75 seconds after starting a task, £0.30 was lost. If a wrong answer was given or a task was not attempted or completed, £0.90 was lost. Each of the 10 pop-up knowledge questions was worth £0.15. If a participant gave a correct answer, there was no deduction. If a participant gave a wrong answer, £0.15 was lost to the group. This incentive structure ensured that participants' performance in every single task and pop-up question would affect the group's pay-off. This reduced the risk of participants giving up due to difficulties in solving some of the tasks. Participants were made aware of the joint incentive structure and that they are part of a group with another participant

in the same session. However, the group assignments were not announced to the participants.

Instead of undergoing the stress treatment procedure, participants in the control group were asked to complete a task which was comparable in length and of a similar nature, but which was not aimed at inducing stress. Specifically, they were asked to answer 14 simple knowledge questions after reading seven short texts about a variety of topics. A sample screenshot of a control task is shown in Figure B.6 of Appendix B. The correct answers to each question could be found in the corresponding text. The questions were similar to those asked via pop-ups during the stress task. Each text and the corresponding two questions were on a single page, allowing the participants to easily move back and forth between questions and texts. Participants were given 10 minutes for this task, there were no consequences from not completing all questions. The task was not incentivised and no "social groups" were formed.
Participants in the treatment group (conditions 1 and 2) received a compensation between £60 and £75 depending on their incentive group's performance in the stress task, the mean compensation received was £67.86. Participants in the control group (conditions 3 and 4) received a compensation of £60. 16 of the 227 participants additionally received the food basket they selected during the food shopping task, worth up to £30.

3.2.5 Food Shopping task

In the food shopping choice, participants were given 10 minutes to allocate a fixed budget of £30 to food and drink items offered in a "virtual supermarket", a computer-based tool similar to online supermarkets. Sample screenshots of the food shopping task are shown in Figures 3.6.9 to 3.6.11 of Appendix 3.6.3. This "virtual supermar-

ket" tool used to record participants' choices was adapted from a tool by Spiteri et al. [27]. A variety of low-calorie and high-calorie food and drink items was available to choose from with prices matching market prices at a local supermarket. Participants were encouraged to make their shopping choices as they would during a weekly shop at their local supermarket.

The supermarket choice was incentivised: 1 out of 15 participants were randomly chosen to receive their chosen basket delivered to their home approximately two weeks after the experimental session. This incentive scheme was chosen to motivate participants to make choices representative of normal shopping behaviour and the 2-week delay in delivery was chosen to ensure that current stocks (of fresh produce in particular) would not affect their choices. Participants were informed that, if they were selected and had not spent the entire £30 budget, they would be paid the difference in cash up to £2 maximum. This was to discourage non-representative shopping choices aimed at spending exactly £30, and to ensure that participants did not feel any pressure to spend the exact amount, which could induce stress for all participants. Under this incentive scheme, it was optimal for participants to aim to spend between £28 and £30.

To examine whether choice complexity leads to less healthy decisions under stress, sessions were pre-assigned to one of two supermarket choice environments (independently of the stress treatment assignment): a simple or a complex choice environment. In both choice environments, 156 grocery items from the following 10 different product categories were on offer: fruit, vegetables, egg and dairy, meat and fish, bread and savoury snacks, pasta and rice, pantry, sweets, ready meals, drinks.

In the simple choice environment, items were displayed on 10 different pages, one for each product category. In the complex choice environment, items were displayed on

a single page, grouped by category but without labelling of categories. The order in which items were displayed within each category was randomized at the participant level to avoid order effects. Furthermore, the display order of categories and the first category shown when opening the supermarket tool was randomized.

3.3 Data

We have collected measures relating to the experience of the experimental treatments and the dietary decisions made by participants in the lab, as well as a range of control variables. In the following, we describe the measures used to test our research question.

3.3.1 Food Choice

Immediate food consumption is captured by the snack choice faced by participants. For a duration of 20 minutes, participants were permitted to consume the snacks provided on their desks: high-calorie blueberry mini-muffins and low-calorie apple slices. Snacks were weighed before and after the experiment, the consumption quantities of each snack type (in grams) are the primary outcomes relating to the snack choice. Secondary outcomes are the total calorie (in kcal), saturated fat (in grams) and sugar content (in grams) of the consumed snacks; these measures are deterministic functions of the two primary outcome variables.

Planned food purchase is captured by the food shopping choice made using the "virtual supermarket" tool. The nutritional content of the baskets selected by participants is calculated. Primary outcomes are the energy (in kcal), the saturated fat (in grams) and the sugar content (in grams) of the chosen basket. The total

weight of fruit and vegetables (in grams) chosen by the participant is considered as a secondary outcome.

3.3.2 Measures of Stress

During the final questionnaire of the experiment, participants were asked about their perceptions of the stress or control task. Specifically they were asked whether they perceived the task as relaxing, easy, stressful, difficult, enjoyable and tiring. Each perception is rated on a 5-point Likert scale from 1 ("not at all") to 5 ("very much"). Of particular interest is the perceived stressfulness of the tasks.

We collected two physiological measures of response to stress: heart rate and salivary cortisol. The heart rate captures the response of the autonomic nervous system (ANS) to stress. Cortisol on the other hand captures the response of the hypothalamic-pituitary-adrenal (HPA) axis.

Participants were asked to wear an armband with an optical heart rate sensor (Polar OH1) during the course of the lab experiment. Heart rate data was recorded in one-second intervals and stored on the internal memory of the sensor. Due to technical problems with the sensors, heart rate data is not available for 29 participants. The resulting heart rate profiles were matched with the precise start times of the experiment and the stress or control task. To capture the heart rate response to the stress or control task, we defined a baseline period of 5 minutes, beginning with the start of the experiment, and a task period of 10 minutes, beginning with the start of the stress or control task. Comparison of the means during the baseline and the task period provides a measure of the heart rate response to the tasks.

Participants were asked to provide three saliva samples during the course of the

experimental session. The baseline sample was collected at the beginning of the experiment, 9 minutes prior to the start of the stress or control task. The second sample was collected 29 minutes after the start of the stress / control task and the final sample was collected 85 minutes after the start of the start / control task. Cortisol reactivity to a stressor is found to peak between 10 and 40 min following the start of the stress protocol [23] and should revert back to a normal level when the final sample is collected.

The samples were collected using synthetic swabs (Sarstedt Salivette Cortisol), which were chewed by participants for 60 seconds and then placed in storage tubes. Samples were frozen immediately after collection. After completion of the experiment, the samples were shipped under dry ice to Daacro Saliva Lab in Trier (Germany) for analysis. Samples were analysed in duplicate for salivary cortisol and testosterone content. Comparison of salivary cortisol of the baseline and the second saliva sample provides a measure of the cortisol response to the tasks.

3.3.3 Stress task performance

Participants in the stress group were asked to complete a 10 minute block of incentivised tasks. Each participant could lose between £0 and £15 to their randomly assigned group. Rescaling this measure to run from 0% (no correct answers given) to 100% (all tasks and pop-ups solved correctly) allows us to capture participants' performance in the stress task.

3.4 Empirical Analysis

3.4.1 Hypotheses

A. If hormonal responses to stress induce a change in preference for energy dense foods, we expect acute stress to increased selection of foods high in calories, sugar and saturated fats. The increase would be stronger in immediate consumption ("snack choice"), driven more prominently by immediate preferences.

B. If stress drains mental resources and worsens the ability to make reasoned decisions, the impact of acute stress will be stronger on planned consumption ("food shopping choice"), especially among participants assigned to the complex choice environment. Here, participants will select more foods high in calories, sugar and saturated fats.

C. The impact of acute stress on both types of food consumption choices will be stronger among participants who cope less well with stress.

3.4.2 Descriptive Statistics

Demographic characteristics of our sample are in Table 3.4.1. The average age of mothers is approximately 36 years and on average, they have two children. 28% of mothers raise their youngest child by themselves. 61% of mothers are married or in a cohabiting relationship. 43% of participants completed GCSEs as their highest qualification, for 38% A levels are the highest qualification. 10% of mothers work full-time, 59% are in part-time employment and 24% are not employed. The only statistically significant difference between the stress and the control group is the age of the youngest child.

Descriptive statistics of the dietary measures used in our analysis are displayed in

Table 3.4.2. On average, participants ate 41g (171 kcal) of the blueberry mini-muffins and 74g (41 kcal) of the apple slices offered during the snack choice. The average shopping basket selected during the food-shopping choice contained approximately 17000 kcal, 460g of fat, 200g of saturated fat and 750g of sugar.

3.4.3 Empirical Strategy

We analyse the impact of acute stress and choice complexity on dietary choices. We first estimate the linear models for the impact of the stress treatment on dietary choices measured with the outcomes described above. We then estimate the relevance of choice complexity on the outcomes related to the food shopping choice. To do so, we include an indicator for being assigned to the stress treatment and also an indicator for assignment to the complex choice environment and the interaction between the two. To capture any potentially confounding factors we include a vector of control variables. The controls are dummy variables for the time of the experimental session, for the consumption of any food in the last hour, any drink in the last hour, any cocoa product in the last 6 hours and any big meal in the last 6 hours. These control variables were chosen as they differed significantly between the treatment and the control group. We estimate all models using the ordinary least squares (OLS) estimator. To account for potential error correlation among individuals in the same experimental session, we estimate standard errors robust to clustering at the session level. Due to the relatively small number of clusters, the wild cluster bootstrap approach proposed by Cameron et al. [7] is used to estimate the clustered standard errors.

Table 3.4.1: Demographic characteristics

	(1) Stress	**(2) Control**	**(1) vs (2) P-Value**
Age - mother	35.7	36.24	0.53
	-5.96	-5.83	
Age - youngest child	5.94	7.1	0.01
	-2.79	-3.09	
No. of children	1.97	2.18	0.15
	-1.01	-1.01	
Single parent	0.28	0.28	0.99
	-0.45	-0.45	
Marital status:			
single	0.21	0.26	0.48
married	0.44	0.39	0.52
cohabiting	0.17	0.21	0.42
other	0.18	0.13	0.42
Monthly HH net income:			
<1000 GBP	0.13	0.09	0.37
1000-2000 GBP	0.46	0.49	0.61
>2000 GBP	0.41	0.42	0.95
Monthly benefits:			
none	0.17	0.11	0.26
1-650 GBP	0.56	0.65	0.23
>650 GBP	0.27	0.24	0.66
Highest qualification:			
none	0.08	0.1	0.68
low GCSE	0.17	0.1	0.18
high GCSE	0.26	0.33	0.33
A levels	0.38	0.37	0.86
professional	0.1	0.1	0.97
Employment status:			
full-time	0.11	0.08	0.43
part-time	0.54	0.64	0.17
self-employed	0.08	0.06	0.45
not employed	0.26	0.22	0.55
N	107	89	196

Table 3.4.2: Descriptive Statistics

	Mean	**SD**	**Min**	**Max**
Snack choice:				
Muffins (g)	41.15	34.8	0	142
Apples (g)	74.46	48.82	0	180
Energy (kcal)	211.64	151.95	0	667.19
Fat (g)	9.13	7.67	0	31.38
Saturated fat (g)	1.15	0.97	0	3.98
Carbohydrates (g)	29.73	19.49	0	89.31
Sugar (g)	20.68	12.41	0	58.51
Protein (g)	1.99	1.53	0	6.51
Salt (g)	0.2	0.15	0	0.65
Shopping choice:				
Energy (kcal)	16960.1	4046.76	7094.9	27061.19
Fat (g)	463.14	197.5	113.29	1167.79
Saturated fat (g)	199.43	95.32	31.32	555.6
Carbohydrates (g)	2304.84	827.72	106.24	4619.4
Sugar (g)	748.31	245.26	87	1675.11
Protein (g)	771.13	169.59	401.07	1199.4
Salt (g)	34.04	9.63	5.23	61.6
Fruit & veg (g)	2838.55	1820.31	0	9164
N	196			

3.4.4 Pre-test of the Experimental Design

The experimental design was pre-tested in June 2018 using a sample of 50 low-income mothers in Florence, Italy. Results from this pre-test using an eligible sample of 41 participants showed the novel stress protocol to be effective.

The stress task was perceived as significantly more stressful than the control task. The mean heart rate of participants in the stress group increased significantly by 7.0 bpm (8.5%) between baseline and the stress task, a difference-in-difference comparison relative to the control group showed a statistically significant increase by 10.0 bpm. A difference-in-difference comparison showed the stress protocol to induce a statistically significant and sizeable increase in salivary cortisol levels. Comparison of salivary cortisol levels before and after completion of the stress/control task showed an increase by 1.1 nmol/L (24.0%) in the stress group and a decrease by 1.1 nmol/L (22.2%) in the control group.

No significant impacts of acute stress on food choices were observed in the pre-test. The consumed quantities in the snack choice and the nutritional content of baskets chosen in the food shopping choice were not found to differ significantly between stress and control group.

3.4.5 Effectiveness of Stress Protocol

Our study relies on the effectiveness of our novel stress protocol in inducing acute stress. We check this effectiveness by examining the participants' perceptions of the stress and control tasks as well as the response of heart rate and salivary cortisol to the tasks. Table 3.4.3 shows participants' mean perceptions of the stress and control tasks. The stress task was perceived as significantly more stressful. With a mean perceived stressfulness of 2.7 on the 5-point Likert scale from 1 ("not at all") to 5

("very much"), the stress task is perceived as mildly stressful. This is a considerable difference to the mean perceived stressfulness of 1.5 for the control task. The stress task was furthermore perceived as significantly less relaxing, less easy, more difficult, less enjoyable and more tiring.

Table 3.4.3: Mean perceptions of stress / control task

	(1) Stressful	**(2) Relaxing**	**(3) Easy**	**(4) Difficult**	**(5) Enjoyable**	**(6) Tiring**	**N**
Treatment	2.745	2.642	3.151	2.5	3.377	2	106
	-0.064	-0.096	-0.107	-0.078	-0.044	-0.089	
Control	1.517	3.382	4.607	1.258	3.652	1.596	89
	-0.094	-0.106	-0.047	-0.062	-0.056	-0.105	
Difference	1.228	-0.741	-1.456	1.242	-0.274	0.404	
P	0	0	0	0	0.002	0.011	
P(Wild)	0	0	0	0	0.005	0.02	

Notes: Perceptions of the stress / control task were scored from 1 for 'not at all' to 5 for 'very much'. Standard errors of the mean were clustered at the session level and are shown in parentheses. For the difference in mean between treatment and control, p-values based on standard errors clustered at the session level and p-values based on a wild bootstrap clustered at the session level are shown.

We now turn to the two measures of physiological response to the task. The first is heart rate, the second is cortisol. Participants wore a heart rate monitor during the course of the experiment to track the physiological response of the autonomic nervous system to the stress and control tasks. Figure 3.4.1 shows the mean heart rate of participants in stress and control group for minute intervals during the baseline (the first 5 minutes of the experiment), the pre-task phase, the task and the post-task phase. There are no significant differences in the heart rate levels during baseline between the stress and control group. The pre-task period shows slightly higher heart rate levels in the stress than in the control group, this is likely due to

anticipation effects as participants are instructed about the tasks during this phase. Significant differences in heart rate appear immediately after the start of the stress and control task. During the first minute of the task, the mean heart rate of participants completing the stress task is 3.8 bpm (4.8%) above the heart rate of those completing the control task. The second minute of the task shows an even larger difference of 6.1 bpm (7.8%). In the remainder of the task stage the difference in mean heart rate reduces somewhat. However, the mean heart rate remains significantly higher in the stress group, with the exception of the last minute of the task when the difference is only marginally significant. The gap in heart rate between the two groups closes within minutes of completing the task, no significant differences are found during the post-task period.

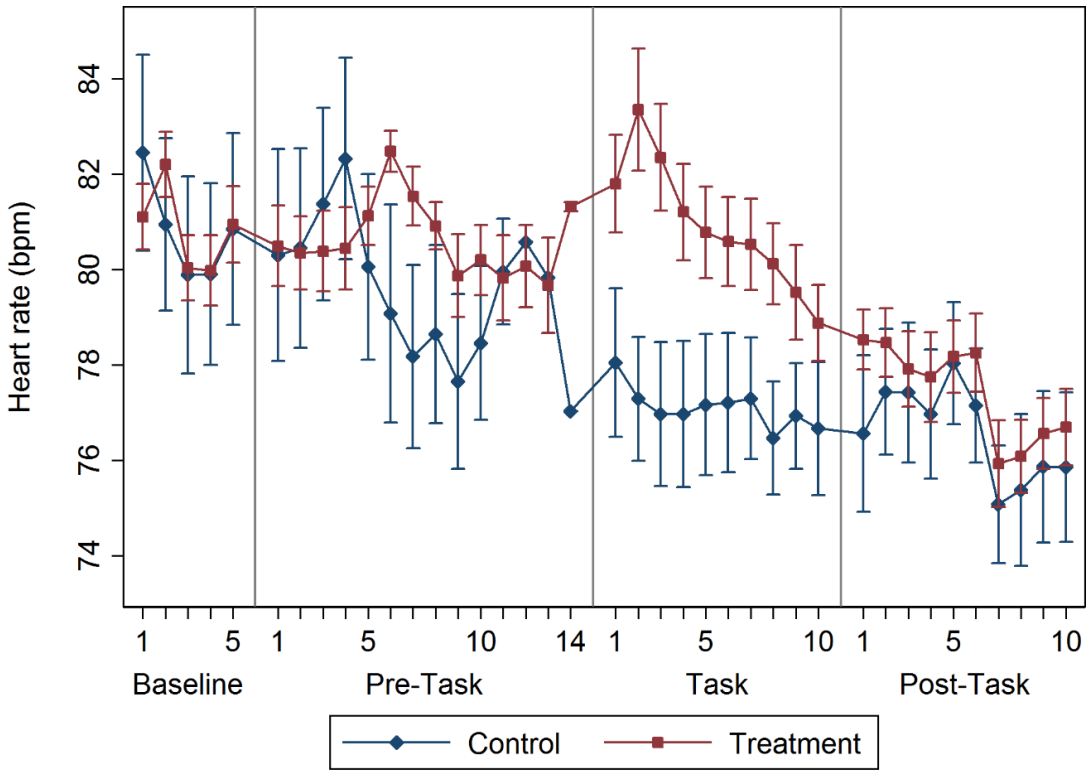

Figure 3.4.1: Heart rate response to stress / control task

Means were calculated for minute intervals based on heart rate data collected every second. Bands indicate +/- standard error. The length of the pre-task period differed across sessions (between 9 min 45 s and 13 min 39 s), but it did not differ significantly between stress and control session.

Difference-in-difference comparison of heart rate means across the two groups and between the baseline and task stages are shown in Table 3.4.4. For the control group, mean heart rate is reduced by 3.7 bpm (4.6%) between baseline and the task stage. This downward trend in heart rate is likely due to an elevated heart-rate from physiological activity (e.g. the walk from the car park to the laboratory) wearing off over time as participants remained seated during this part of the experiment.

For the stress group, we observe no significant change in mean heart rate from the baseline to the task stage. The downward trend observed in the control group is cancelled out in the stress group by the increase in heart rate caused by the acute stressor. The difference-in-difference comparison shows a significantly increased heart rate during the stress task by 3.8 bpm relative to the control group. In other relevant studies reported in Appendix 3.6.1, Table 3.6.1, no significant difference in heart rate in found when using stressors related to mathematical skills or similar to the Trier test.

Table 3.4.4: Heart rate response to stress / control task

	(1) Baseline	**(2) Task**	**(2)-(1) Diff**	**P**	**P(Wild)**	**N**
Treatment	80.854	80.917	0.062	0.916	0.902	94
	(0.638)	(0.927)				
Control	80.807	77.104	-3.703	0.000	0.020	73
	-1.840	-1.307				
Diff-in-Diff			3.766	0.001	0.000	167

Notes: Means were calculated based on heart rate data collected every second. Standard errors were clustered at the session level and are shown in parentheses. For the difference between task and baseline, p-values based on standard errors clustered at the session level and p-values based on a wild bootstrap clustered at the session level are shown.

Over the course of the experiment, we collected three saliva samples from each participant to track the physiological response of the hypothalamic-pituitary-adrenal (HPA) axis to the stress and control tasks. A baseline sample was collected prior to completion of the stress or control task, a second sample 29 minutes after the start of the task and a final sample at the end of the experimental session. Figure 3.4.2 shows the mean salivary cortisol concentrations of participants in the stress and control groups across these three measurements. Other experiments, using the Trier Social stress Test or mathematical tasks, have shown an increase in cortisol level after the stressor and a subsequent decrease in the post-experimental period. For both groups, we observe a downward trend in salivary cortisol over the course of the experiment. With the exception of a marginally significant difference in baseline cortisol, we do not observe any differences in salivary cortisol between the stress and control group.

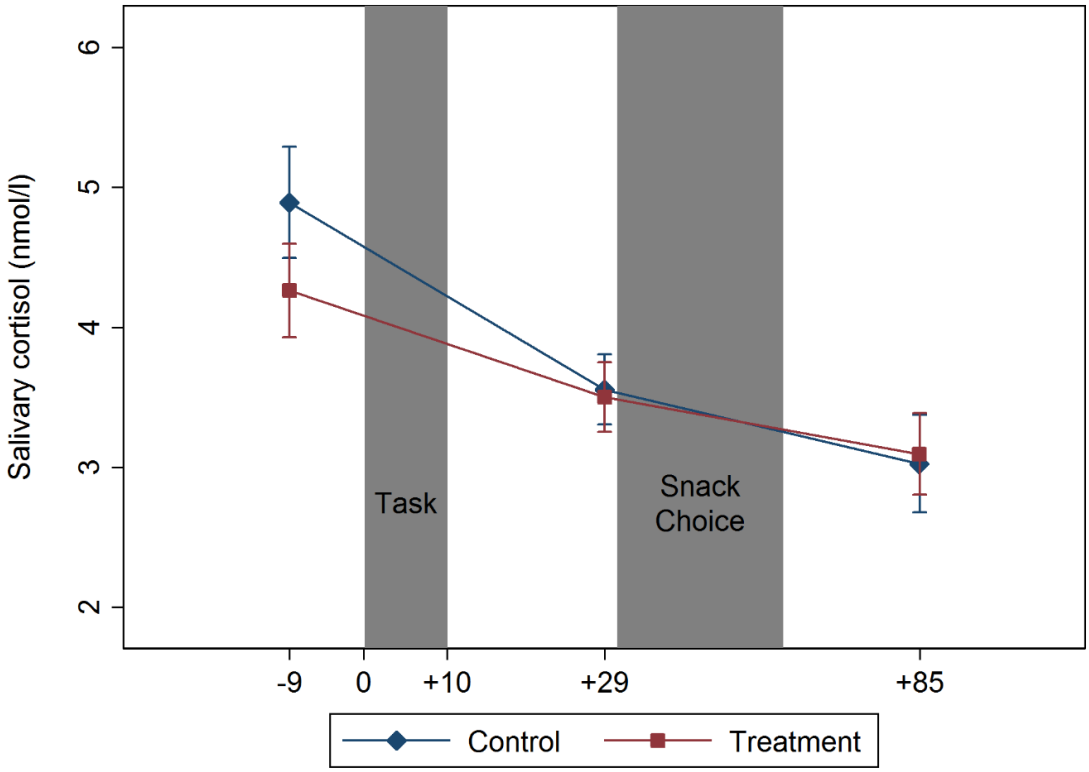

Figure 3.4.2: Salivary cortisol response to stress / control task

Bands indicate +/- standard error.

Difference-in-difference comparison of mean cortisol concentrations across the two groups are shown in Table 3.4.5. A comparison of the cortisol change from the baseline to the second measurement shows a marginally significant difference, with cortisol concentrations decreasing less in the stress group. As this result is entirely driven by differences in the baseline cortisol levels, it cannot be used as indication of a cortisol response to the acute stressor.

Our findings show that the stress protocol was perceived as mildly stressful. An

Table 3.4.5: Salivary cortisol response to stress / control task

	(1)	**(2)**	**(3)**	**(2)-(1)**			
	Baseline	**Post-Task**	**End**	**Diff**	**P**	**P(Wild)**	**N**
Treatment	4.262	3.500	3.095	-0.761	0.001	0.008	107
	(0.322)	(0.240)	(0.282)				
Control	4.892	3.556	3.025	-1.335	0.000	0.009	89
	(0.384)	(0.241)	(0.336)				
Diff-in-Diff				0.574	0.089	0.094	196

Notes: Standard errors were clustered at the session level and are shown in parentheses. For the difference between post-task and baseline, p-values based on standard errors clustered at the session level and p-values based on a wild bootstrap clustered at the session level are shown.

increased heart rate during the stress task indicates a physiological response of the autonomic nervous system to this stressor. We do not observe a response of the hypothalamic-pituitary-adrenal (HPA) axis to our stress protocol. However, the lack of a cortisol response should not be seen as indication of a failure to induce stress, as cortisol measurement are very sensitive to the timing of the measurements (relative to the stressor) and to a variety of unobservable factors. Also, we do not find any correlation between the stress level measured in the lab and the chronic stress during the last 3 months, measured with the questionnaire.

3.4.6 Impact of Acute Stress on Food Choices

In the following, we examine the impact of acute stress by comparing the food choices made during the experiment by participants assigned to the stress and control group (Hypothesis A). We consider food choices in the context of immediate and planned consumption.

Table 3.4.6 shows OLS results for the impact of acute stress on immediate food consumption as captured by the snack choice during the experiment. Columns (1) and (3) correspond to bivariate models. In columns (2) and (4) we control for the time of the experimental session and for the consumption of foods and drinks prior to the experiment. As shown in column 1, participants in the control group ate 38.2g of the high-calorie mini-muffins. Participants in the treatment group consumed an additional 5.4g of the muffins. While this difference is not negligible in size, it is not statistically significant. When controlling for potentially confounding factors that differed between stress and control groups in column 2, we observe a similar difference in muffin intake of 5.1g, which again is not statistically significant.

As reported in column 3, subject in the control condition ate 72.8g of the low-calorie apple slices while participants in the treatment condition ate an additional 3.1g. This difference in apple intake increases to 5.7g when controlling for session time and for the prior consumption of foods and drinks in column 4. In both specifications, the difference in apple consumption between stress and control group is not precisely estimated. While we observe acute stress to increase intake of both high- and low-calorie snacks, these increases are not statistically significant.

When examining the total energy, saturated fat and sugar intake from both snack types (see Table 3.6.3 of Appendix 3.6.4), we again find no statistically significant differences between stress and control group.

We now turn to examining the impact of acute stress on planned future food

Table 3.4.6: Impact of acute stress on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	5.396	5.081	3.053	5.736
	(0.433)	(0.394)	(0.627)	(0.406)
	[0.454]	[0.443]	[0.644]	[0.476]
Constant	38.202***	48.178***	72.798***	78.699***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

consumption, by analysing the nutrient content of the baskets selected during the food shopping choice by participants in the stress and control group. OLS results for the impact of the stress protocol on total energy, saturated fat and sugar content of the selected grocery items can be found in Table 3.4.7. Participants in the control group selected baskets with a mean energy content of 17,138 kcal, 202g of saturated fat and 775g of sugar. Results for the bivariate models in columns 1, 3 and 5 show participants in the stress group on average selected baskets containing 327 kcal less energy, 5g less saturated fat and 48g less sugar. When controlling for the timing of the experimental sessions and the intake of food and drink prior to arrival, the differences in energy and saturated fat content are substantially reduced, to 103 kcal and 2g respectively. The difference in sugar content, on the other hand, increases slightly to 53g. The differences in nutrient content of baskets selected by the stress and

control groups are not statistically significant in any of the specifications. In further estimations (see Table 3.6.4 of Appendix 3.6.4), we find no significant difference in the weight of fruit and vegetables purchased by the stress and control groups. These findings do not support the hypothesis that acute stress leads to less healthy food choices in the context of planned consumption. Summarizing, these results suggest no significant relationship between mild stress and either immediate or planned food consumption.

Table 3.4.7: Impact of acute stress on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	-326.627	-103.019	-5.403	-2.101	-48.356	-52.720
	(0.482)	(0.820)	(0.594)	(0.860)	(0.269)	(0.257)
	[0.503]	[0.838]	[0.585]	[0.861]	[0.295]	[0.302]
Constant	17138.414***	17068.346***	202.380***	199.379***	774.705***	783.333***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

3.4.7 Role of choice complexity

We now examine whether the complexity of the food shopping choice affects the healthiness of the chosen grocery items, in particular under acute stress (Hypothesis B). OLS results for the impact of the stress protocol and the choice complexity (both randomly pre-assigned) on the nutrient content of the chosen food-shopping basket

are reported in Table 3.4.8. Results in columns 1 and 2 show a lower energy content of baskets selected in the complex choice environment, both among the stress and the control group. As shown in columns 3 and 4, we observe the saturated fat content of baskets selected in the complex choice environment to be lower in the control, but higher in the stress group. Columns 5 and 6 show the sugar content of baskets chosen in the complex choice environment to be higher in the control, but lower in the stress group. The impact of choice complexity on the above outcomes is not statistically significant. Thus, the evidence does not suggest stress to have differential effects on dietary choices depending on the complexity of the choices.

Table 3.4.8: Impact of acute stress and choice complexity on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	-222.230	-20.000	-7.775	-4.740	-18.233	-22.833
	(0.755)	(0.974)	(0.524)	(0.736)	(0.754)	(0.701)
	[0.793]	[0.980]	[0.603]	[0.785]	[0.804]	[0.770]
Complex	-340.412	-214.320	-10.009	-11.634	42.809	42.745
	(0.618)	(0.749)	(0.505)	(0.427)	(0.399)	(0.415)
	[0.668]	[0.791]	[0.615]	[0.613]	[0.464]	[0.505]
Treatment * Complex	-221.648	-201.619	5.366	5.072	-66.574	-63.893
	(0.792)	(0.802)	(0.794)	(0.814)	(0.431)	(0.515)
	[0.807]	[0.826]	[0.803]	[0.856]	[0.470]	[0.673]
Constant	17291.408***	17126.435***	206.878***	204.421***	755.465***	759.469***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

3.4.8 Role of coping style and stress response

In additional estimations, we examine whether certain coping styles or a strong physiological or psychological response to the experimental stressor affect the susceptibility of participants' dietary choices to the acute stress protocol (Hypothesis C). The self-assessed use of avoidance-based, emotion-oriented and task-oriented coping styles are not found to significantly alter the dietary choices made by the stress group (see Tables 3.4.9 and 3.4.10). Despite some significant coefficient estimates, we find no strong evidence that perceiving the task as stressful makes participants' food choices more susceptible to the stressor (see Tables 3.6.5 and 3.6.6 of Appendix 3.6.4). The physiological responses to the stressor as captured by the heart rate and salivary cortisol response do not predict stronger susceptibility of participant's choices to the stress protocol (see Tables 3.6.7 to 3.6.10 of Appendix 3.6.4).

3.4.9 Role of emotional eating, time preferences and risk attitudes

We do not find evidence that the self-assessed tendency to eat when emotional, as captured by the emotional eating dimension of the Dutch Eating Behaviour Questionnaire [30], affects the dietary response to stress (see Tables 3.6.11 and 3.6.12 of Appendix 3.6.4). Self-assessed time preferences, both generally and in the context of health, are not found to alter the susceptibility of participants' dietary choices to the experimental stressor (see Tables 3.6.13 and 3.6.14 of Appendix 3.6.4). Self-assessed general risk aversion is found to significantly decrease muffin intake in the snack choice, however only in the control group (see Table 3.6.15 of Appendix 3.6.4). In the food shopping choice, general risk aversion is found to decrease energy content of baskets selected by participants in the stress group, this association is marginally

Table 3.4.9: Impact of acute stress and coping style on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	1.964	5.192	44.084	55.531
	(0.961)	(0.899)	(0.304)	(0.197)
	[0.968]	[0.919]	[0.307]	[0.205]
Coping: avoidance	-1.034	0.086	10.160*	11.224*
	(0.686)	(0.971)	(0.041)	(0.019)
	[0.672]	[0.978]	[0.094]	[0.078]
Coping: emotion	2.983	2.581	3.828	3.847
	(0.388)	(0.448)	(0.402)	(0.378)
	[0.422]	[0.492]	[0.439]	[0.388]
Coping: task	-4.961	-5.321	3.512	2.968
	(0.378)	(0.388)	(0.457)	(0.517)
	[0.447]	[0.420]	[0.463]	[0.546]
Treatment * Avoidance	1.975	0.831	-10.935	-11.992
	(0.691)	(0.877)	(0.212)	(0.183)
	[0.741]	[0.910]	[0.215]	[0.186]
Treatment * Emotion	-3.785	-2.020	-5.885	-5.467
	(0.354)	(0.666)	(0.373)	(0.390)
	[0.376]	[0.666]	[0.397]	[0.409]
Treatment * Task	2.203	0.781	2.654	0.725
	(0.727)	(0.909)	(0.693)	(0.924)
	[0.733]	[0.913]	[0.717]	[0.930]
Constant	52.018	61.636*	16.832	22.009
	(0.135)	(0.083)	(0.548)	(0.371)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.4.10: Impact of acute stress and coping style on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	1490.410	1676.567	0.452	23.098	249.014	232.883
	(0.652)	(0.631)	(0.995)	(0.735)	(0.225)	(0.263)
	[0.644]	[0.615]	[0.997]	[0.743]	[0.251]	[0.310]
Coping: avoidance	-101.176	-123.614	4.890	4.042	-18.582	-17.944
	(0.849)	(0.828)	(0.549)	(0.655)	(0.512)	(0.525)
	[0.854]	[0.837]	[0.568]	[0.665]	[0.582]	[0.573]
Coping: emotion	-307.176	-352.800	-14.458	-14.280	9.768	9.415
	(0.590)	(0.544)	(0.088)	(0.076)	(0.651)	(0.657)
	[0.593]	[0.557]	[0.199]	[0.130]	[0.832]	[0.855]
Coping: task	364.684	366.391	5.651	7.662	58.496	57.868
	(0.524)	(0.529)	(0.433)	(0.282)	(0.149)	(0.164)
	[0.519]	[0.521]	[0.425]	[0.305]	[0.223]	[0.227]
Treatment * Avoidance	-478.921	-411.252	-10.300	-8.326	2.923	1.634
	(0.462)	(0.551)	(0.279)	(0.401)	(0.925)	(0.959)
	[0.462]	[0.592]	[0.244]	[0.398]	[0.920]	[0.972]
Treatment * Emotion	61.582	124.442	13.533	12.592	-11.708	-9.660
	(0.929)	(0.860)	(0.311)	(0.369)	(0.726)	(0.760)
	[0.921]	[0.866]	[0.313]	[0.366]	[0.741]	[0.747]
Treatment * Task	-120.450	-216.977	-4.020	-9.630	-67.354	-65.017
	(0.890)	(0.810)	(0.812)	(0.550)	(0.138)	(0.180)
	[0.887]	[0.814]	[0.812]	[0.536]	[0.182]	[0.215]
Constant	16917.933***	17021.025***	209.556***	201.177***	565.223**	574.240***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)	(0.008)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

significant (see Table 3.6.16 of Appendix 3.6.4).Altogether, the evidence we collected provides no empirical support to the hypothesis that acute stress leads to unhealthier dietary choices.

3.5 Impact of failure

In additional estimations, we examine the impact of task performance on dietary choices (see Tables 3.5.1 and 3.5.2). Table 3.5.1 shows OLS results for the impact of acute stress on immediate food consumption, controlling for the performance in the stress task. Task performance can range from 0 to 100, where 100 corresponds to solving all 15 tasks and 10 pop-up questions correctly and without a time penalty. We estimate an extremely poor performance in the stress task to increase muffin intake by 30.8g compared to the control group, which corresponds to an intake of 127.8 additional kcal, as shown in column 1. This difference is not only big in magnitude, but also statistically significant. An improvement in task performance by 1 standard deviation, reduces muffin intake by 10.3g (a 0.29 std reduction in muffin intake). Controlling for potentially confounding factors in column 2 leads to similar results. There is no significant effect on the intake of apple slices.

Table 3.5.2 reports the impact of acute stress on planned future food consumption, controlling for stress task performance. We estimate an extremely poor performance in the stress task to decrease the energy content of the selected basket by 2152 kcal, the saturated fat content by 35g and the sugar content by 68g. Performing well in the task increases energy, saturated fat and sugar content of the selected basket. Also when controlling for the timing of the experimental sessions and the intake of food and drink prior to arrival, the magnitude of these estimates are similar. The differences in nutrient content of baskets selected by the stress and control groups

and the effect of stress task performance are though however not statistically significant in any of the specifications.

While performance in the task was not experimentally assigned and hence these results cannot be interpreted as causal, we find a substantial and statistically significant correlation of a lower performance in the stress task and an increased consumption of high-calorie snacks. Participants who fail the task consume almost double the amount of calories than participants in the control group, with this increase reducing with success in the task. This hints at the role of failure in mediating an impact of acute stress on the intake of high-calorie foods. This effect seem in line with the literature, where often solvable versus unsolvable tasks are used to study stress-induced changes in dietary choices, possibly hinging on failure to find an impact on food consumption (see Appendix 3.6.1, Table 3.6.1 for a review of the stressors used)

3.6 Conclusion

In this study, we examine the impact of acute stress on food choices, both in the context of immediate and planned consumption, by evaluating a lab experiment with 196 low-income mothers. We employed a novel incentivised stress protocol developed to mimic everyday stressors in low-income families. At the start of the experiment, participants in the treatment group were asked to complete this stress task, while participants in the control group were asked to complete a control task. Afterwards, participants were asked to purchase food items in a "virtual supermarket" as part of an incentivised food shopping choice and were offered high- and low-calorie snacks for immediate consumption. We use the nutritional content of the chosen food-shopping basket and the quantity of snacks eaten to determine the impact of acute stress on planned and immediate food consumption choices. We asked participants about

Table 3.5.1: Impact of acute stress and task performance on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	30.803***	31.214***	4.903	5.510
	(0.003)	(0.001)	(0.648)	(0.661)
	[0.009]	[0.000]	[0.641]	[0.666]
Stress task performance	-0.502***	-0.516***	-0.037	0.004
	(0.000)	(0.000)	(0.874)	(0.985)
	[0.009]	[0.007]	[0.869]	[0.987]
Constant	38.202***	48.098***	72.798***	78.700***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.5.2: Impact of acute stress and task performance on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	-2152.804	-1813.934	-34.934	-32.259	-68.013	-70.393
	(0.142)	(0.216)	(0.237)	(0.315)	(0.332)	(0.344)
	[0.198]	[0.216]	[0.290]	[0.469]	[0.384]	[0.372]
Stress task performance	36.098	33.798	0.584	0.596	0.389	0.349
	(0.179)	(0.225)	(0.243)	(0.271)	(0.745)	(0.776)
	[0.208]	[0.248]	[0.401]	[0.395]	[0.776]	[0.721]
Constant	17138.414***	17073.556***	202.380***	199.471***	774.705***	783.387***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

their perceptions of the stress or control task and measured their salivary cortisol as well as their heart rate over the course of the experimental sessions to assess the stressfulness of the stress task.

The novel stress protocol was perceived by participants as significantly more stressful than the control task. This is supported by a significant increase in the heart rate of participants in the stress group when compared to the control group. We, however, do not observe a significant difference in the cortisol levels of the stress and the control group. Cortisol responses can be problematic to induce and measure, so this should not be seen as a failure to induce stress. The task perceptions and heart rate data are reliable evidence that mild stress was induced among the stress group, but not among the control group.

We do not find evidence of a significant impact of acute stress on immediate or

planned food choices. Previous findings in the literature report a positive impact of acute stress, induced using artificial stressors such as unsolvable mathematical tasks or the Trier stress test, on food consumption. Contrary to these studies, our stressor does not produce a change in food choices. The complexity of the choice environment, participants' coping styles as well as the psychological and physiological response to the experimental stressor are not found to affect the susceptibility of dietary choices to acute stress. If we control for performance in the task though, we find that poor performance leads to a higher intake of calorie dense foods (muffins).

In future research, we plan to study the impact of experimentally assigned stress and failure on immediate food consumption and a series of measures related to depletion of cognitive skills. We also plan to separate the impact of stress and failure from the one of stress.

Our stress protocol is designed to mimic stressors our sample often faces in real life. We acknowledge finally, as limitation of research conducted experimentally in the lab, that stress induced in the lab is not comparable in magnitude to the one participants might face in their daily lives.

Appendix

3.6.1 Literature on Stress and Diet

Paper	Sample	Stressor	Measure of stress	Magnitude of the change in stress	Dietary Outcome measure	Magnitude of the dietary effect
Oliver et al. (2000)	27 male and 41 female (mean age 26). Between subjects.	Prepare a 4-minute speech, expecting it to be filmed and assessed vs. listen to a passage of neutral text.	Heart rate, blood pressure and self-reported measure of perceived stressfulness (on a scale from 1 to 7).	Non-significant change in heart rate. Stress group with higher blood pressure and significantly more stressed (M=4.26 ± 1.4 vs M=1.62 ±1.0)	Appetite, food intake during a 15 min meal. Sweet, salty, and bland + low and high fat food.	No effects of stress on weight of food consumed, energy intake, energy density (kcal/g), or preference for certain macronutrients. Increase intake of sweet fatty foods in emotional eaters.
Epel et al. (2001)	59 women, 30 to 45 years (mean age 36). Within subjects, 2 days.	Adapted 45 min version of the Trier Social Stress Test (Kirschbaum et al., 1993) vs. sat quietly, reading and listening to music.	10 salivary cortisol samples and the Profile of Mood States (POMS) negative affect scales (McNair et al., 1981).	Cortisol (area under the curve, AUC, to capture total cortisol exposure) significantly higher on the stress day than the rest day (M=28.6 ± 1.7 vs M=22.6 ± 1.5).	Food intake over 30 min break. Sweet, salty + low and high fat snacks.	On the stress day, high cortisol reactors consumed more calories than low reactors (calories M=216.3 ± 29 vs M=137.3 ± 31.8). On the control day, however, high reactors consumed similar amounts (calories M=176.7 ± 27 vs M=187.2 ± 29.9)
Roemmich et al. (2002)	23 boys and 17 girls, 8 to 11 years. Within subjects, 2 days.	15 minutes to prepare and 5 minutes to deliver a speech, videotaped and judged vs reading childrenâ^{TM}s magazines and colouring.	Self-reported measure of perceived stressfulness (100-mm visual analog scale).	High reactivity stress group significantly more stressed, from 20 to more than 40 mm. No significant increase in the low reactivity group.	Calories consumed out of 500 calorie portions of the three favourite snack food.	When stressed, low-restrained children reduced energy intake by 61 kcal, and high-restrained children increased it by 46 kcal.
Zellner et al. (2006)	34 female undergraduate students (mean age 22). Between subjects.	10 unsolvable five-letter anagrams vs 10 solvable five-letter anagrams with a word-bank of the answers at the bottom of the page.	Self-reported measure of perceived stressfulness (on a scale from 0 to 10).	Stress group significantly more stressed than the control (M= 5.8 ± 3.0 vs M= 0.7 ± 1.1)	Food intake of M&M chocolate candies, Lays potato chips, Planter's dry roasted peanut, and red seedless grape.	No significant differences in consumption of either the peanuts or the potato chips. The no-stress group ate more grapes (M= 15.6 ± 22.3g vs M= 4.0 ± 7.2g). The stress group ate more M&Ms (M= 6.9 ± 10.4 g vs M= 1.2 ± 2.4 g).
Newman et al. (2007)	50 women (mean age 33.96). Within subjects, 1 day.	15 min Trier Social Stress Test vs reading magazines and listening to a "Classical Chillout" compact disc.	Salivary cortisol samples at different points in time. Self-reported measure of perceived stressfulness (on a scale from 1 to 7).	Average cortisol increase of 1.36 nmol/l ± 3.77 (difference mean baseline cortisol level maximum after the stressor). Mean self-reported stressfulness 4.78.	Relationship between hassles and snack intake outside the laboratory in high and low cortisol reactors.	In high reactors, significant positive associations between hassle number and snack intake (b=0.39, p<0.01), and hassle intensity and snack intake (b=0.51, p<0.001).
Zellner et al. (2007)	36 male undergraduate students (mean age 20). Between subjects.	10 unsolvable five-letter anagrams vs 10 solvable five-letter anagrams with a word-bank of the answers at the bottom of the page.	Self-reported measure of perceived stressfulness (on a scale from 0 to 10).	Stress group significantly more stressed (M=5.7 ± 3.1 vs M=1.9 ± 1.9).	Food intake of M&M chocolate candies, Lays potato chips, Planter's dry roasted peanut, and red seedless grape.	No significant difference in the overall grams of food consumed. The control group ate significantly more of the "unhealthy" snacks (chips and M&Ms).

Habhab et al. (2009)	40 female students, 18 to 41 years (mean age 21.3). Between subjects.	15 min to complete an unsolvable Sudoku puzzle vs 15 min to complete an easily solvable puzzle (role of faiulure)	Self-reported level of stress and frustration during and after the Sudoku (10-point scales)	Stress group significantly more stressed during Sudoku (M=8.25 ± 2.83 vs M=4.45 ± 2.74) and after Sudoku (M=6.15 ± 3.65 vs M=3.25 ± 1.89).	Food intake of M&M chocolate candies, potato chips, salty pretzels, honey-flavoured graham crackers. Offered as thank-you for participation.	The stress group ate significantly more food (M=56.30 ± 25.83 vs M=34.50 ± 24.31), more sweet food (M=41.50 ± 20.45 vs M=16.40 ± 15.41) and more high-fat food (M=36.80 ± 20.10 vs M=7.35 ± 9.84). No difference in salty food consumed.
Rutters et al. (2009)	65 men and 65 women, 18 to 45 years. Within subjects.	A mental arithmetic task with sums that subjects could not solve vs could solve. (role of faiulure)	Heart rate, blood pressure, the POMS and state anxiety (STAI).	No changes in heart rate and blood pressure. Stress group significantly more anxious after the task, no change in the control group (4.2 ± 5.7 vs. -0.8 ± 0.3, P<0.001).	Snack intake during 30 min break.	Significant differences in energy intake from sweet snack foods (708.1 ± 798.8 vs. 599.4 ± 734.4kJ, P<0.03) and total energy intake (965.2 ± 970.6 vs. 793.8 ± 912.5kJ, P<0.01).
Appelhans et al. (2010)	16 lean and 18 obese women, 25 to 45 years. Within subjects, 2 days.	Adapted 30 min version of the Trier Social Stress Task vs viewing and evaluating a nature documentary film.	Salivary cortisol samples before, 20 min from the onset and after task. Positive and Negative Affect Schedule (PANAS) on arrival, pre-task and post-task.	Post-task cortisol significantly higher on the stress day (4.06 ng/ml vs. 3.56 ng/ml; F(1,31)=13.33, P<0.001), adjusting for pre-task levels. Negative affect increased over time on the stress day (F(1,31) = 11.04, P<0.01).	Food intake of caramel flavoured miniature rice cakes, low-fat butter popcorn, miniature chocolate chip cookies, and potato chips.	No significant difference in grams of food consumed over the 2 days. Higher cortisol reactivity predicted lower snack intake among obese, not among lean women.
Born et al. (2010)	9 females (mean age 24). Within subject, 2 days.	An unsolvable mathematical test vs solvable test. (role of faiulure)	5 blood samples, 2 functional MRI (fMRI) scans.	Post-task blood cortisol significantly higher on the stress day (133.73 ± 16.33 vs 111.92 ± 9.26)	Self-reported satiety and hunger. Food intake in two meals (breakfast after the first scan and a postprandial meal after the second scan).	Significantly lower scores for satiety after breakfast in the stress condition. Significantly more energy dense food items selected in the absence of hunger in the stress condition.

3.6.2 Recruitment materials

An exciting new research study in Colchester

We are a team of economists from the Universities of Essex, Edinburgh, Bath and the European University Institute and we are interested in understanding how people take a variety of common decisions.

Take part and you will earn between £60 and £75

Do you match the following profile?

- You are the mother of at least one child between 2 and 12 years
- You are between 18 and 45 years old
- You live in the Colchester area
- Your annual household after-tax income is below £35 000
- You do not hold a university degree or are currently enrolled at university
- You have not been pregnant in the past 6 months

We would like to invite you to the ESSEXLab at the University of Essex for a duration of 2 hours, taking place between October 15th and 19th, 2018. Childcare will be provided for free during your visit.

You will receive a compensation of £60 to £75. You will also have the chance to win a free basket of food delivered to your home (worth £30).

Find out more and register now at **www.decisionstudy.co.uk** or call **07981 112 493**.

We look forward to welcoming you as part of our study!

Figure 3.6.1: Leaflet for recruitment

Prof. Michèle Belot
School of Economics
University of Edinburgh
30-31 Buccleuch Place
Edinburgh, EH8 9JT

September 2018

Do you live near Colchester and would be interested in taking part in a paid research study?

We would like to invite you to take part in a **paid research study.** We are a team of economists and we are interested in understanding how people take a variety of common decisions, for example making the choice between different products when shopping.

The study will take place at the ESSEX Lab of the University of Essex in Colchester. If you decide to participate, you will be asked to come to our facilities **for two hours at an arranged date**. You are welcome to bring your child along, childcare facilities will be available for free during the session.

During the session we will ask you to fill out a series of computer-based questionnaires and complete some decision making tasks. All the information we collect will remain anonymous and confidential, and the study has been approved by the Ethics Committee at the University of Edinburgh.

You will receive **a minimum compensation of £60 (up to a maximum of £75)**, payable in cash at the end of the session. You will also have the **chance to win a free basket of food delivered to your home** (worth £30).

The study will be held in the week of **October 15th - 19th, 2018.** You will be able to pick a time and date that best suits you.

The study focuses on mothers of young children. To participate, you need to:

- Have at least one child between 2 and 12 years
- Be between 18 and 45 years old
- Live in the Colchester area
- Have an annual household after-tax income below £35,000
- Have no university degree and not be currently enrolled at university
- Have not been pregnant in the past 6 months.

Everyone matching these criteria is encouraged to participate in the study, no knowledge of social sciences is necessary.

If you are interested in participating in this study, register online at **www.decisionstudy.co.uk.** Alternatively you can call or text us at **07981 112 493** or send an e-mail to **decisionstudy@ed.ac.uk.**

We look forward to welcoming you as part of our study.

Kindly note that in the interest of full disclosure, this letter has been sent by a private marketing intelligence company and is part of a large recruitment effort we are undertaking in the area of Colchester. We do not hold any personal information about you or your household.

Yours Sincerely,

Prof. Michèle Belot

www.decisionstudy.co.uk **07981 112 493** **decisionstudy@ed.ac.uk**

To opt-out of receiving any further information, email opt-out@bbsltd.co.uk

Figure 3.6.2: Letter for recruitment

3.6.3 Experiment Set-Up and Experimental Tasks

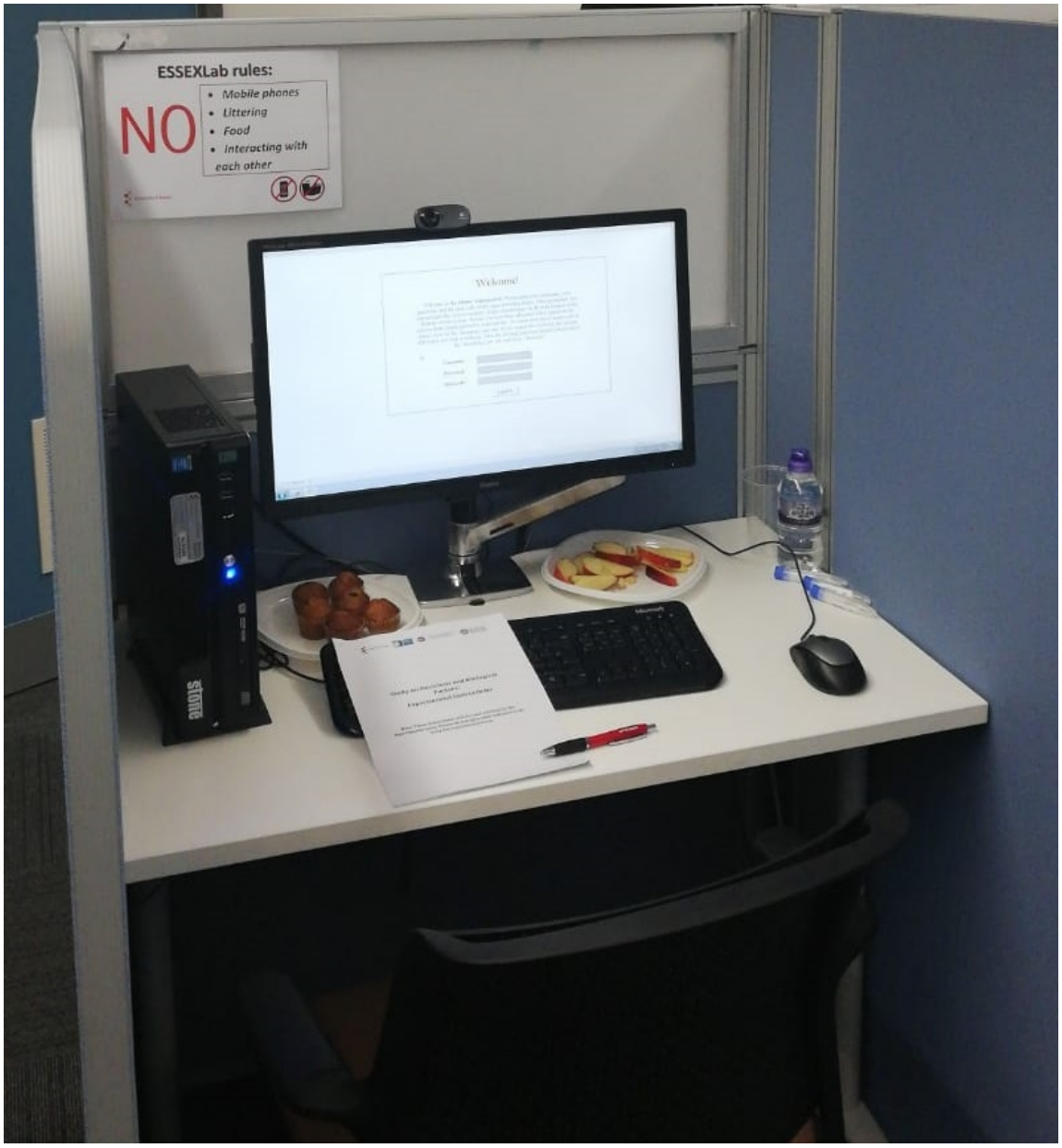

Figure 3.6.3: Picture of participant desk prior to experimental session

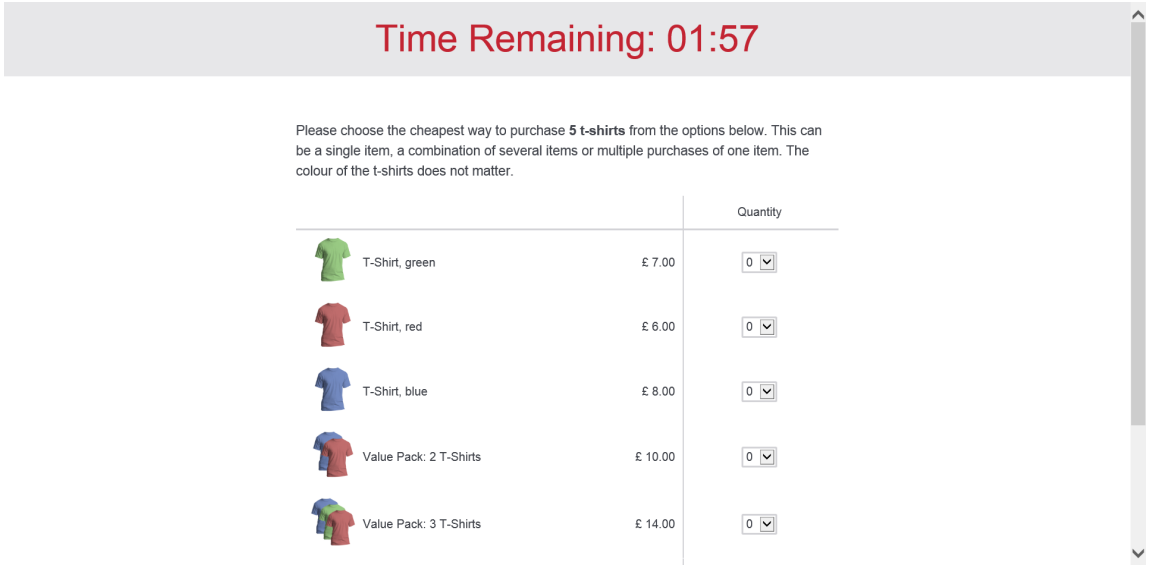

Figure 3.6.4: Screenshot of a budget task

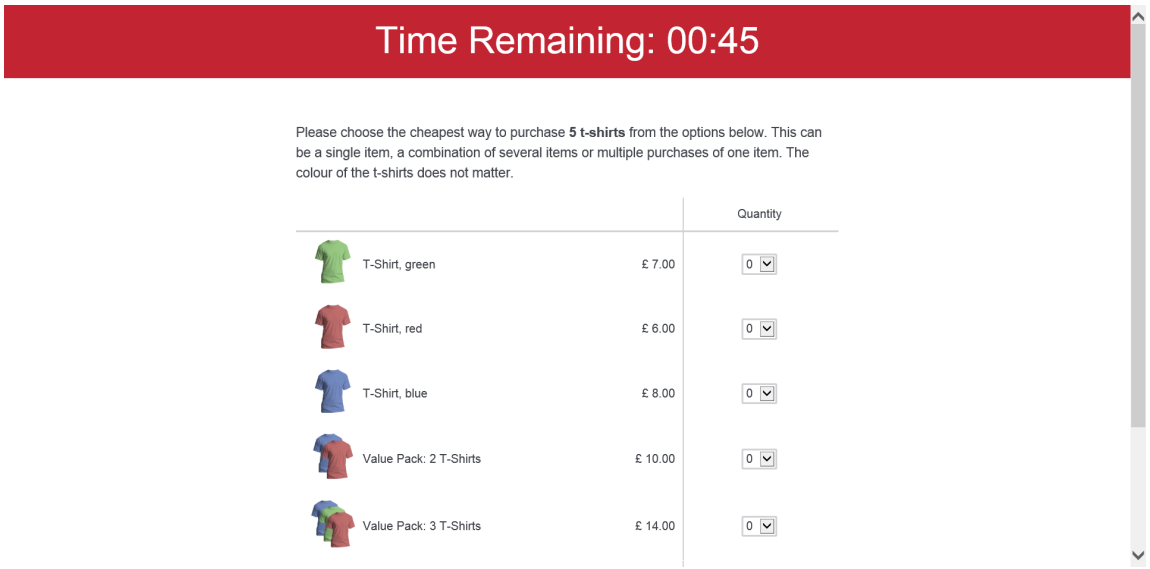

Figure 3.6.5: Screenshot of a budget task after the countdown timer turns red

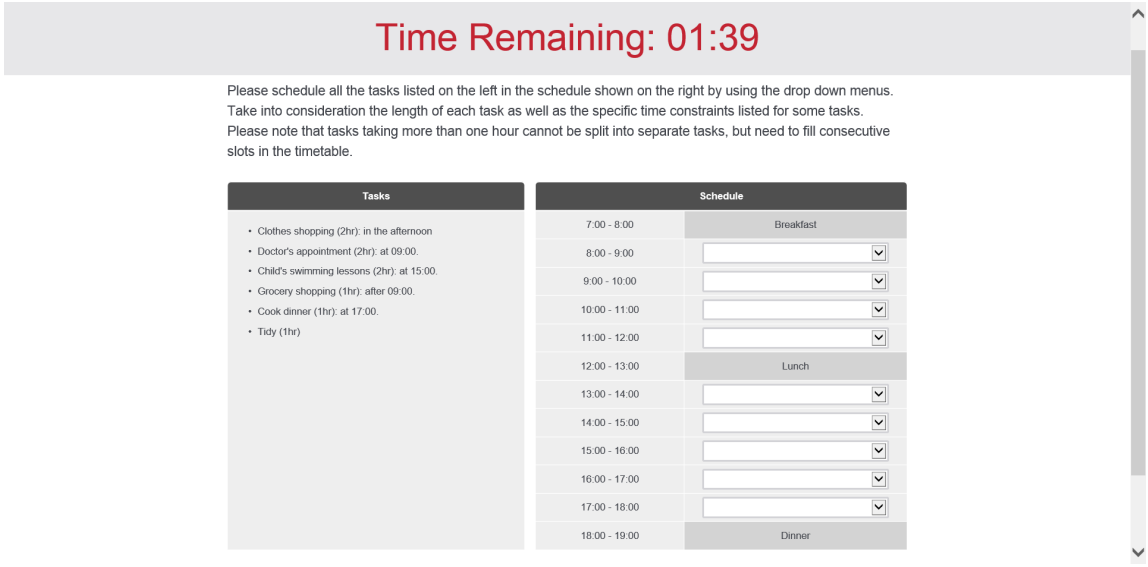

Figure 3.6.6: Screenshot of a time management task

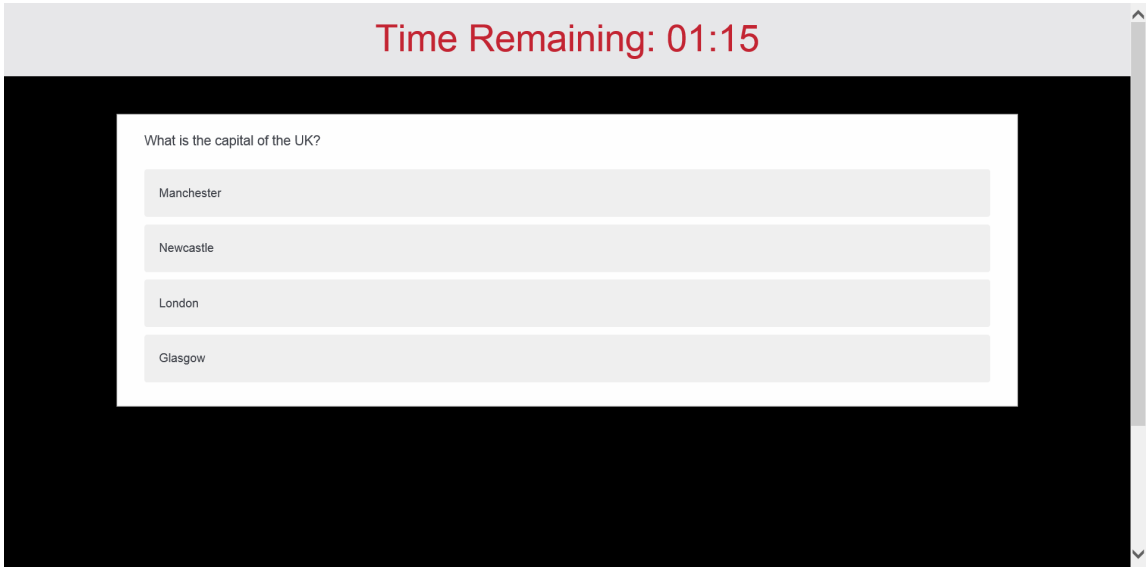

Figure 3.6.7: Screenshot of a pop-up with a knowledge question

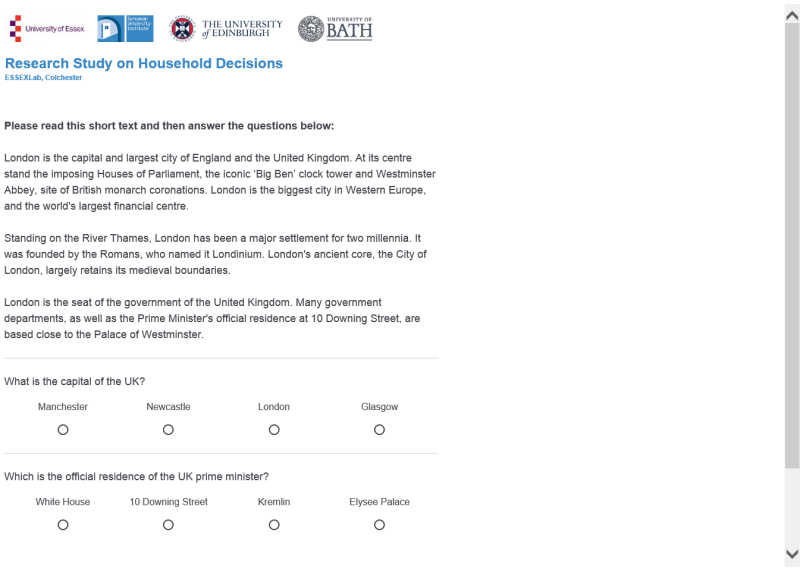

Figure 3.6.8: Screenshot of a control task

Figure 3.6.9: Screenshot of food shopping task - categorized version

Figure 3.6.10: Screenshot of food shopping task - long version

Figure 3.6.11: Screenshot of food shopping task - shopping cart

3.6.4 Additional Results

Table 3.6.2 reports the level of control variables at baseline across different treatment groups. There is no significant difference at baseline between treatments.

Table 3.6.2: Balance of control variables across groups

		(1) Stress	(2) Control	(1) vs (2) P-Value
Session time:	10:30	0.43	0.33	0.14
	14:00	0.22	0.42	0.00
	17:00	0.35	0.26	0.19
	Room temperature	22.90	22.89	0.92
	(0.69)	(0.47)		
Diet - mother:	vegetarian	0.07	0.06	0.79
		(0.25)	(0.23)	
	vegan	0.00	0.00	.
		(0.00)	(0.00)	
	allergies	0.02	0.02	0.85
		(0.14)	(0.15)	
	intolerances	0.03	0.00	0.11
		(0.17)	(0.00)	
	other	0.05	0.02	0.36
		(0.21)	(0.15)	
	Snack position: apples - right	0.44	0.45	0.88
		(0.50)	(0.50)	
	Previous experiment	0.21	0.16	0.39
		(0.41)	(0.37)	
	Food - last 1hr	0.18	0.06	0.01
		(0.38)	(0.23)	
	Big meal - last 6hrs	0.19	0.09	0.05
		(0.39)	(0.29)	
	Cocoa - last 6hrs	0.08	0.03	0.14
		(0.28)	(0.18)	
	Drink - last 1hr	0.26	0.13	0.03
		(0.44)	(0.34)	
	Alcohol - last 24hrs	0.18	0.15	0.55
		(0.38)	(0.36)	
	Caffeine - last 6hrs	0.50	0.51	0.89
		(0.50)	(0.50)	
	Medication - last 24hrs	0.36	0.34	0.69
		(0.48)	(0.48)	
	Exercise - last 6hrs	0.27	0.21	0.35
		(0.45)	(0.41)	
	Smoker	0.30	0.28	0.78
		(0.46)	(0.45)	
	Cigarettes per day	8.56	8.12	0.73
		(4.85)	(4.75)	
	Any allergies	0.38	0.36	0.73
		(0.49)	(0.48)	
	Regular medication	0.27	0.33	0.41
		(0.45)	(0.47)	
	Oral contraceptive	0.27	0.22	0.46
		(0.45)	(0.42)	
	Menopause	0.01	0.00	0.36
		(0.10)	(0.00)	
	Endocrine disorders	0.00	0.00	1.00
		(0.14)	(0.15)	
	N	107	89	196

Tables 3.6.3 and 3.6.4 perform the analysis of the impact of acute stress on secondary outcomes for snack consumption and food shopping. We find no significant impact on acute stress on the secondary outcomes.

Table 3.6.3: Impact of acute stress on snack consumption - secondary outcomes

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	24.069	24.236	0.151	0.142	1.886	2.128
	(0.439)	(0.376)	(0.433)	(0.394)	(0.456)	(0.359)
	[0.474]	[0.427]	[0.473]	[0.470]	[0.502]	[0.417]
Constant	198.505***	243.143***	1.070***	1.349***	19.651***	23.170***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Tables 3.6.5 and Tables 3.6.6 examine the impact of perceived stressfulness of the task on snack choice and on food shopping decision. The perceived stressfulness of the task does not have any significant impact on the outcomes.

Table 3.6.4: Impact of acute stress on food shopping - secondary outcome

	Fruit & veg (g)	
	(1)	**(2)**
Treatment	-193.571	-335.937
	(0.527)	(0.276)
	[0.538]	[0.348]
Constant	2944.225***	3117.919***
	(0.000)	(0.000)
Controls for:		
Session time	No	Yes
Time since food/drink	No	Yes
N	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Tables 3.6.7 -3.6.8 and 3.6.9 -3.6.10 examine the impact of heart rate response and of salivary cortisol response on snack choice and on food shopping decision. None of these measures has a significant impact on the outcomes. Tables 3.6.11 and 3.6.12 analyse the impact of emotional eating, measured via the DEBQ questionnaire, on snack choice and on food shopping decision. Tables 3.6.13 - 3.6.14 and 3.6.15 - 3.6.16 study the impact of time preferences and risk attitudes on snack choice and on food shopping decision. Here again we do not find a significant impact on the outcomes.

Table 3.6.5: Impact of acute stress and perceived stressfulness on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	-14.025	-12.134	-4.606	1.101
	(0.179)	(0.207)	(0.723)	(0.929)
	[0.208]	[0.231]	[0.747]	[0.934]
Task perception: stressful	-5.188	-4.332	2.012	3.049
	(0.196)	(0.301)	(0.611)	(0.440)
	[0.274]	[0.336]	[0.597]	[0.419]
Treatment * Stressful	9.463*	8.208	1.628	-0.140
	(0.034)	(0.066)	(0.750)	(0.977)
	[0.084]	[0.101]	[0.744]	[0.980]
Constant	46.071***	54.221***	69.746***	74.680***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	195	195	195	195

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.6: Impact of acute stress and perceived stressfulness on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	1.102.994	1.529.846	-24.655	-23.639	75.010	71.793
	(0.422)	(0.257)	(0.218)	(0.352)	(0.372)	(0.373)
	[0.466]	[0.283]	[0.225]	[0.339]	[0.391]	[0.428]
Task perception: stressful	80.999	95.805	0.662	1.178	54.606	55.449
	(0.825)	(0.825)	(0.807)	(0.761)	(0.132)	(0.130)
	[0.892]	[0.895]	[0.805]	[0.784]	[0.081]	[0.117]
Treatment * Stressful	-548.764	-609.869	6.157	6.255	-69.615*	-70.220*
	(0.278)	(0.252)	(0.373)	(0.449)	(0.081)	(0.073)
	[0.326]	[0.292]	[0.367]	[0.418]	[0.049]	[0.051]
Constant	17015.549***	16927.178***	201.375***	198.578***	691.876***	703.664***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	195	195	195	195	195	195

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.7: Impact of acute stress and heart rate response on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	3.936	4.764	-4.402	-1.175
	(0.586)	(0.430)	(0.622)	(0.896)
	[0.623]	[0.495]	[0.647]	[0.897]
HR response	0.586	0.543	2.235	1.954*
	(0.237)	(0.127)	(0.062)	(0.077)
	[0.295]	[0.139]	[0.105]	[0.050]
Treatment * HR response	-2.108**	-1.952**	-3.293	-2.877
	(0.020)	(0.021)	(0.093)	(0.128)
	[0.035]	[0.021]	[0.122]	[0.150]
Constant	38.351***	45.225***	82.334***	86.993***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	167	167	167	167

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.8: Impact of acute stress and heart rate response on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	-514.505	-221.535	9.456	12.999	-117.593	-123.976
	(0.312)	(0.717)	(0.401)	(0.353)	(0.049)	(0.056)
	[0.311]	[0.741]	[0.394]	[0.376]	[0.150]	[0.129]
HR response	46.689	49.511	-1.840	-2.176	10.941	11.609
	(0.329)	(0.435)	(0.176)	(0.165)	(0.238)	(0.220)
	[0.370]	[0.454]	[0.284]	[0.196]	[0.371]	[0.358]
Treatment * HR response	-65.971	-76.362	2.705	3.651	-15.934	-17.892
	(0.520)	(0.527)	(0.170)	(0.089)	(0.172)	(0.127)
	[0.547]	[0.555]	[0.183]	[0.114]	[0.261]	[0.219]
Constant	17356.296***	17268.058***	191.697***	195.132***	833.433***	826.130***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	167	167	167	167	167	167

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.9: Impact of acute stress and cortisol response on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	5.835	6.464	7.305	10.746
	(0.358)	(0.306)	(0.384)	(0.275)
	[0.407]	[0.360]	[0.429]	[0.309]
Cortisol response	-0.103	-0.976	-0.822	-1.676
	(0.929)	(0.536)	(0.788)	(0.638)
	[0.894]	[0.484]	[0.703]	[0.622]
Treatment * Cortisol response	0.499	1.119	4.965	5.485
	(0.818)	(0.679)	(0.296)	(0.302)
	[0.802]	[0.686]	[0.324]	[0.310]
Constant	38.065***	47.129***	71.700***	76.794***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.10: Impact of acute stress and cortisol response on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	-981.277	-770.142	-10.592	-7.157	-83.132	-86.448
	(0.098)	(0.213)	(0.464)	(0.663)	(0.123)	(0.140)
	[0.115]	[0.255]	[0.488]	[0.668]	[0.144]	[0.209]
Cortisol response	293.895**	318.747*	6.523*	6.462*	7.848	7.720
	(0.032)	(0.078)	(0.063)	(0.056)	(0.261)	(0.331)
	[0.012]	[0.032]	[0.007]	[0.051]	[0.264]	[0.300]
Treatment * Cortisol resp.	-638.248*	-656.673	-1.900	-1.860	-39.755	-39.666
	(0.029)	(0.064)	(0.868)	(0.877)	(0.056)	(0.089)
	[0.062]	[0.111]	[0.884]	[0.887]	[0.169]	[0.165]
Constant	17530.846***	17419.281***	211.090***	206.157***	785.185***	792.532***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.11: Impact of acute stress and emotional eating on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	4.206	3.741	-3.238	-1.181
	(0.750)	(0.786)	(0.872)	(0.951)
	[0.765]	[0.787]	[0.874]	[0.946]
Emotional eating (DEBQ)	4.004	3.589	8.930	8.285
	(0.407)	(0.460)	(0.133)	(0.154)
	[0.427]	[0.594]	[0.190]	[0.228]
Treatment * Emot. eating	0.132	0.207	1.646	1.898
	(0.979)	(0.969)	(0.837)	(0.804)
	[0.985]	[0.976]	[0.842]	[0.808]
Constant	28.254**	39.049***	50.608***	57.576***
	(0.019)	(0.005)	(0.001)	(0.001)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.12: Impact of acute stress and emotional eating on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	822.685	966.618	-7.719	-3.345	116.061	110.854
	(0.689)	(0.637)	(0.890)	(0.952)	(0.150)	(0.189)
	[0.730]	[0.679]	[0.884]	[0.955]	[0.137]	[0.207]
Emotional eating (DEBQ)	304.946	286.068	-3.375	-3.763	40.935**	41.143**
	(0.663)	(0.685)	(0.853)	(0.836)	(0.026)	(0.024)
	[0.714]	[0.721]	[0.910]	[0.832]	[0.040]	[0.024]
Treatment * Emot. eating	-450.344	-420.648	1.121	0.768	-64.217**	-64.116**
	(0.527)	(0.564)	(0.958)	(0.971)	(0.043)	(0.043)
	[0.555]	[0.592]	[0.962]	[0.979]	[0.036]	[0.032]
Constant	16380.662***	16356.524***	210.767***	208.913***	672.988***	681.088***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.13: Impact of acute stress and time preferences on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	16.018	15.804	8.307	7.581
	(0.263)	(0.316)	(0.470)	(0.510)
	[0.276]	[0.328]	[0.462]	[0.455]
Patience (general)	-1.521	-1.436	-0.671	-1.167
	(0.307)	(0.300)	(0.712)	(0.482)
	[0.487]	[0.439]	[0.738]	[0.502]
Treatment * Patience (general)	0.838	0.708	0.018	0.260
	(0.670)	(0.699)	(0.996)	(0.932)
	[0.691]	[0.713]	[0.996]	[0.931]
Patience (health)	1.516	1.566	0.467	0.508
	(0.451)	(0.407)	(0.822)	(0.824)
	[0.496]	[0.514]	[0.822]	[0.845]
Treatment * Patience (health)	-2.708	-2.594	-0.935	-0.546
	(0.323)	(0.325)	(0.794)	(0.881)
	[0.355]	[0.349]	[0.778]	[0.874]
Constant	38.179***	47.268***	73.918***	82.216***
	(0.001)	(0.001)	(0.000)	(0.000)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.14: Impact of acute stress and time preferences on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	152.480	459.685	2.492	-1.881	10.596	17.966
	(0.909)	(0.718)	(0.925)	(0.948)	(0.918)	(0.866)
	[0.905]	[0.730]	[0.935]	[0.928]	[0.912]	[0.874]
Patience (gen.)	-14.767	-12.180	-2.416	-2.991	-1.220	-0.148
	(0.929)	(0.936)	(0.315)	(0.245)	(0.934)	(0.993)
	[0.915]	[0.938]	[0.368]	[0.280]	[0.933]	[0.994]
Treatment * Patience (general)	187.922	195.229	8.161	8.338	0.133	-0.453
	(0.525)	(0.491)	(0.271)	(0.276)	(0.995)	(0.982)
	[0.562]	[0.485]	[0.292]	[0.307]	[0.994]	[0.977]
Patience (health)	254.740	299.108	1.401	0.523	15.983	17.178
	(0.151)	(0.095)	(0.611)	(0.865)	(0.234)	(0.221)
	[0.215]	[0.185]	[0.653]	[0.854]	[0.407]	[0.435]
Treatment * Patience (health)	-277.673	-296.092	-9.711*	-8.589	-10.605	-11.907
	(0.341)	(0.300)	(0.076)	(0.116)	(0.560)	(0.522)
	[0.382]	[0.327]	[0.090]	[0.165]	[0.583]	[0.566]
Constant	15792.446***	15476.369***	207.985***	212.565***	691.892***	689.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.15: Impact of acute stress and risk attitudes on snack consumption

	Muffins (g)		**Apples (g)**	
	(1)	**(2)**	**(3)**	**(4)**
Treatment	-6.278	-9.112	13.553	17.158
	(0.611)	(0.396)	(0.513)	(0.406)
	[0.662]	[0.414]	[0.531]	[0.426]
Risk aversion (general)	-3.190*	-3.134*	1.273	1.217
	(0.030)	(0.021)	(0.318)	(0.307)
	[0.090]	[0.079]	[0.330]	[0.350]
Treatment * Risk aversion (general)	4.830*	4.788*	-2.098	-2.382
	(0.046)	(0.055)	(0.527)	(0.528)
	[0.071]	[0.080]	[0.554]	[0.554]
Risk aversion (health)	1.603	1.314	-1.754	-2.037
	(0.049)	(0.108)	(0.209)	(0.147)
	[0.147]	[0.235]	[0.243]	[0.224]
Treatment * Risk aversion (health)	-1.285	-0.898	-0.207	-0.081
	(0.402)	(0.564)	(0.951)	(0.981)
	[0.447]	[0.558]	[0.945]	[0.971]
Constant	41.198***	52.899***	78.563***	86.287***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:				
Session time	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes
N	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

Table 3.6.16: Impact of acute stress and risk attitudes on food shopping

	Energy (kcal)		**Saturated fat (g)**		**Sugar (g)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Treatment	368.281	743.754	-65.422	-63.875	-21.147	-31.241
	(0.844)	(0.684)	(0.112)	(0.096)	(0.793)	(0.681)
	[0.847]	[0.700]	[0.138]	[0.131]	[0.831]	[0.667]
Risk aversion (general)	217.069	234.869	-7.182	-6.620	-9.632	-9.374
	(0.063)	(0.044)	(0.264)	(0.299)	(0.403)	(0.437)
	[0.156]	[0.106]	[0.336]	[0.334]	[0.447]	[0.446]
Treatment * Risk aversion (general)	-656.131**	-696.041**	8.479	7.379	-18.285	-17.789
	(0.032)	(0.016)	(0.242)	(0.304)	(0.206)	(0.203)
	[0.036]	[0.024]	[0.323]	[0.334]	[0.198]	[0.213]
Risk aversion (health)	-92.555	-115.876	0.860	0.592	17.671	17.843
	(0.542)	(0.409)	(0.915)	(0.941)	(0.086)	(0.088)
	[0.516]	[0.426]	[0.919]	[0.929]	[0.170]	[0.166]
Treatment * Risk aversion (health)	300.287	306.633	3.816	4.664	5.913	6.277
	(0.186)	(0.152)	(0.652)	(0.580)	(0.587)	(0.551)
	[0.214]	[0.180]	[0.701]	[0.617]	[0.626]	[0.582]
Constant	16831.276***	16825.043***	226.297***	223.548***	703.596***	709.320***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls for:						
Session time	No	Yes	No	Yes	No	Yes
Time since food/drink	No	Yes	No	Yes	No	Yes
N	196	196	196	196	196	196

Notes: P-values based on standard errors clustered at the session level are shown in parentheses. P-values based on a wild bootstrap clustered at the session level are shown in brackets. Significance levels correspond to the largest p-value obtained from both methods and are indicated as follows: * p<0.1, ** p<0.05, *** p<0.01

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